MASTER'S THESIS

Nature conservation and human activities: conflicting or compatible?

Exploring the disturbance effects on vulnerable birds for Natura 2000 conservation measures in the Oesterdam area

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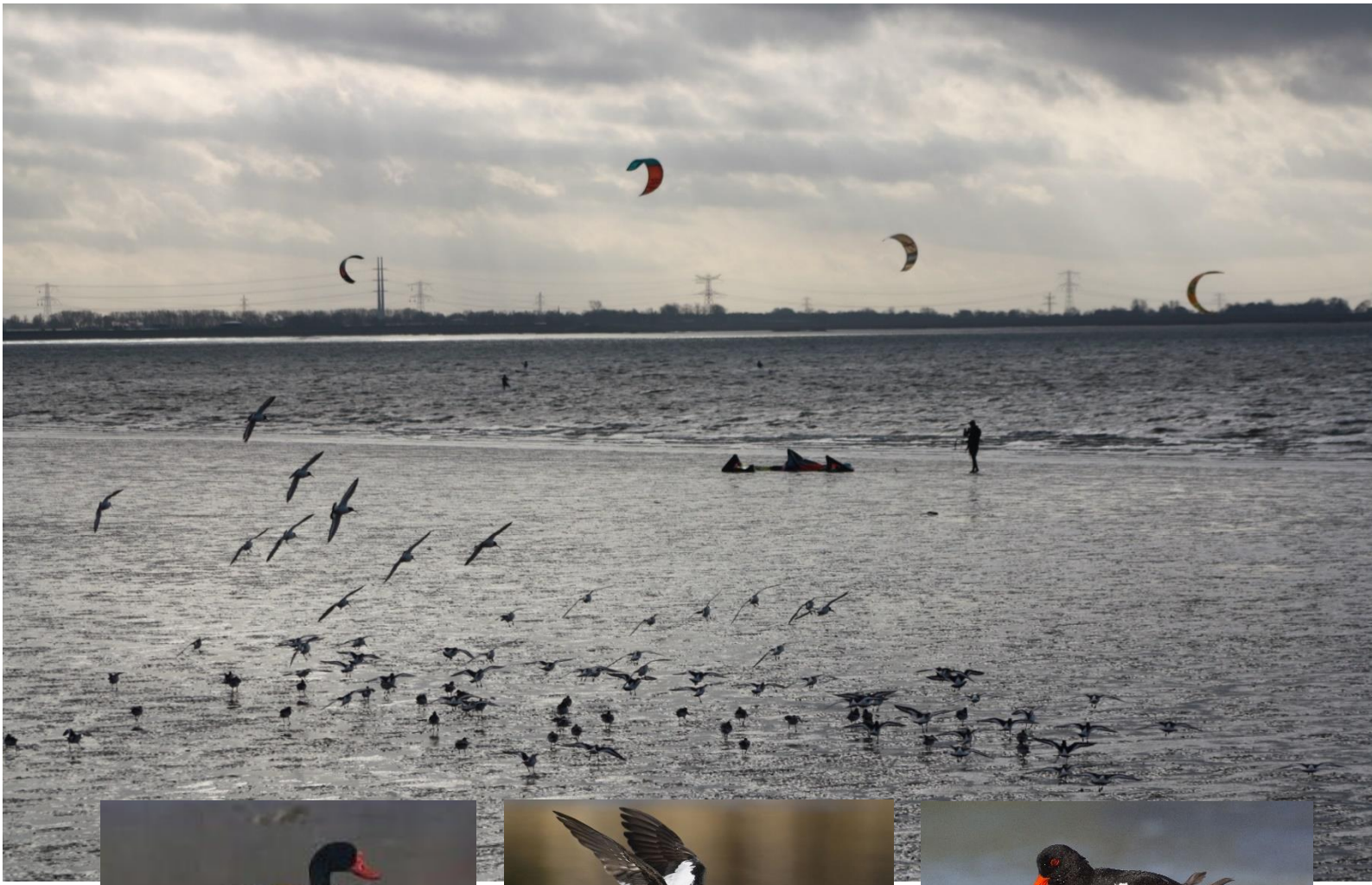

Master Thesis

Yvonne Bosch

Nature conservation and human activities: conflicting or compatible?

Exploring the disturbance effects on vulnerable birds for Natura 2000 conservation measures in the Oesterdam area

Natuurbehoud en menselijke activiteiten: conflicterend of verenigbaar?

Onderzoek naar de verstorende effecten op kwetsbare vogels ten behoeve van Natura 2000 instandhoudingsmaatregelen in het Oesterdamgebied

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Summary

This thesis describes the use of the Oesterdam area, part of Natura 2000 area Oosterschelde, by birds and recreants. Due to the construction of the storm surge barrier, the Oosterschelde estuary is affected by sand deficit. Sand nourishment was carried out at the Oesterdam in 2013, aiming at counteracting the effects of the prevailing sand deficit problem and at bird conservation. An additional effect was the sudden increase of recreation in the area. The main research question of this thesis is: *'How does the interaction between vulnerable birds, recreation, and sand dynamics complicate Natura 2000 conservation measures of the Oesterdam area?'*

To answer this question, a literature study, observations, interviews with stakeholders and a Delphi study among ecological experts were carried out, and bird counting data were collected. In this study the focus was on the shelduck, goldeneye and oystercatcher as vulnerable birds. The study showed that the Oesterdam area has great potential as a bird habitat despite emerging recreation. It appears to be relatively important for the shelduck, goldeneye and oystercatcher compared to the Oosterschelde as a whole. Still, sand deficit and recreation could reinforce each other's negative effect on birds. Although recreation in the area is very diverse, it is believed that kitesurfing is the most disturbing form of recreation due to its unpredictable movements. Disturbance effects of extensive recreation on birds can be expected, both behavioural and physiological ones, especially in winter, endangering conservation objectives.

Determining disturbance effects on vulnerable birds is complicated by several uncertainties: knowledge of bird species, different recreational activities and their impact, and availability of suitable habitats, is lacking. Bird behaviour and population effects are unpredictable, and there is ambiguity related to severity of disturbance in foraging areas or high tide roosts, and related to whether wind could create a natural separation between kitesurfers and vulnerable birds. Therefore, in addition to disturbance, deciding on conservation measures should also be based on food availability, having a major impact on vulnerability of bird species.

Sand nourishment as a measure to increase the foraging area for birds, is complicated by the temporary disappearance of the foraging area and the fact that it is also attractive for recreation. It is unclear what the ecological and recreational values are of various sub-areas in the whole Oosterschelde area. Zoning of different forms of recreation in time or place depends on these values, both for the Oesterdam area as for the Oosterschelde as a whole. Closing the Oesterdam area to all recreation in winter could be recommended. Since regulations are unclear, and are different for kitesurfers and other recreational users, the legal situation has to be clarified. As a result, the rules would be easier to understand for recreants and enforcement could be carried out more easily. This could make nature friendly measures for recreational activities successful.

Contents

1 Introduction

1.1 The interaction between nature and humans

The natural environment is exposed to human influence. In the Netherlands, nature has to be protected based on the Dutch Nature Conservation Act. However, nature conservation is not the only aim pursued in natural environments. Recreational activities are organized or promoted by organizations like Natural Monuments (Natuurmonumenten) and State Forest Service (Staatsbosbeheer) (Natuurmonumenten, 2019; Staatsbosbeheer, 2019). Physical activity and spending time outdoors are also recognized as beneficial for both physical and mental health and well-being (Eigenschenk et al., 2019). According to Van Marwijk (2009) two visions on the combination of recreation and nature can be distinguished. First, based on psychological, ecological and economical arguments, nature and recreation should go hand in hand (nature and recreation as partners). And second, nature and recreation should be separated in space and in time, since the growth in recreational activities increases the pressure on the natural environment (nature and recreation as rivals). When recreation is not adequately zoned in space and time, conflicts might arise between nature conservation and recreational use of the site (Van Veen et al., 2010).

Knowledge uncertainties are often an important aspect of the persistence of conflicts between humans and nature (Pouwels, Opdam, & Jochem, 2011), which complicate nature conservation measures. A currently conflicting interaction between conservation values and human activities is taking place in the Oesterdam area, in the easternmost part of the Oosterschelde (see Appendix I).

1.2 Nature conservation and Natura 2000

1.2.1 Conservation of Natura 2000 sites

Natura 2000 is a network of protected areas in Europe and the largest nature conservation network in the world (European Commission, 2019). The aim of Natura 2000 is to protect vulnerable habitats and species under the legislation of the Birds Directive (79/409/ECC), amended in 2009 (2009/147/EC), and the Habitats Directive (92/43/EEC)[1]. Conservation objectives are formulated for each habitat type or (bird) species. These objectives indicate whether conservation is aimed at maintenance of the current state, or at restoring a favourable conservation status, that is a situation in which habitat type or species is prospering in both quality and extent or population (Sundseth & Roth, 2014). The impact of

[1] **The Birds Directive**: "*Member States shall take the requisite measures to maintain the population of the species referred to in article 1 at a level which corresponds in particular to ecological, scientific and cultural requirements, while taking account of economic and recreational requirements, or to adapt the population of these species to that level*," (article 2, Birds Directive, 2009/147/EC). **The Habitat Directive**: "*Member States shall take appropriate steps to avoid, in the special areas of conservation, the deterioration of natural habitats and the habitats of species as well as disturbance of the species for which the areas have been designated, in so far as such disturbance could be significant in relation to the objectives of this Directive.*" (article 6 (2), Habitat Directive, 92/43/ECC).

all present and future activities in or nearby protected sites has to be assessed for significance (European Commission, 2016). Since both the Habitat and the Bird Directive emphasize that conservation of species and habitats should be guaranteed, a significant effect may arise if, as a consequence of an intervention, the future area of the habitat, number of a species or quality of a habitat declines compared to its state as mentioned in the conservation objective (Steunpunt Natura 2000, 2010). The assessment of significance could be difficult because of the complexity of ecological relationships, and the interactions with the cumulative effects of other (proposed) activities in the same area or external impacts (Möckel, 2017; Steunpunt Natura 2000, 2010). In addition, it is not always clear whether mitigation measures can prevent significant effects (Möckel, 2017). The approach of Natura 2000 is to allow people to make use of nature protection sites, but in a sustainable way, both ecologically and economically (European Commission, 2019). Human disturbance is increasingly becoming a concern regarding nature conservation, since wild life is becoming more and more exposed to human activities (Whitfield, Ruddock, & Bullman, 2008).

1.2.2 Management of Natura 2000 in the Netherlands

In the Netherlands, the Birds and Habitats Directive are implemented in the Nature Conservation Act ("Wet natuurbescherming," 2017, 1 January). Although the aim is nature conservation, recreational activities are permitted in nature reserves as much as possible (Vos, Opdam, & Pouwels, 2003). Natura 2000 sites are formally designated by the Minister of Agriculture, Nature and Food Quality. According to the Nature Conservation Act, each Province is responsible for the conservation of its protected areas, with the exception of policy on the main waterways and open waters, and of international policy issues, which are assigned to the national government ('Ministry of Infrastructure and Water Management'). The government provides the theoretical framework (Broekmeyer & Pleijte, 2016).

To establish the Natura 2000 network, it is important to publish 'Designation decisions' that present the objectives for each area (Ministerie van Landbouw Natuur en Voedselkwaliteit, 2006). Subsequently, a 'Management plan' will be drawn up, stating, among other things, which measures are required to achieve the conservation objectives, taking into account the current use of the area, and the activities for which a permit is needed (Ministerie van Landbouw Natuur en Voedselkwaliteit, 2006). In addition, 'Access restrictions decisions' (TBBs; *toegangsbeperkingsbesluiten* in Dutch) will be established to assign sites needing additional protection with restrictive access possibilities. A TBB is assessed for a part of the Natura 2000 site with ecological core values as well as external pressure. The existence of a TBB does not have to imply that access is prohibited for all activities.

1.3 The Oosterschelde and the Oesterdam area

1.3.1 Characteristics of the Oosterschelde

The Oosterschelde is a tidal basin in the southwest of the Netherlands (see Figure 1). Internationally, it is an important area for migratory birds to rest and to forage. On a national scale, the Oosterschelde is a rich nature reserve because of its intertidal flats, the shallow water areas, salt marshes and the importance for wading and breeding birds, and seals. For this reason the Oosterschelde area was designated as a Natura 2000 site in February 2010 (Ministerie van Landbouw Natuur en Voedselkwaliteit, 2019; Provincie Zeeland, 2018).

Figure 1: *Geographical overview of the situation of the Oosterschelde (small yellow rectangle on the left, and red outlined area on the right), and the Oesterdam area (in the yellow rectangle in the map on the right) (Ministerie van Infrastructuur en Milieu: Rijkswaterstaat, 2016).*

The Oosterschelde is part of the Dutch Delta Waters. The 'Delta works', consisting of dykes, dams and barriers, initiated after the North Sea flood of 1953, changed the Oosterschelde from an open estuary into a coastal bay behind a semi-open storm surge barrier (M. P. Boersema et al., 2018). This storm surge barrier, completed in 1986, caused the Oosterschelde to undergo substantial physical and ecological changes. A decrease in tidal velocity due to the working of the storm surge barrier causes a decrease in sediment transport (M. P. Boersema et al., 2018; Van der Werf et al., 2019), resulting in intertidal flat erosion, known as the 'sand deficit problem' (M. P. Boersema et al., 2018). The sand deficit in turn caused the ecological functioning of this area to decrease. This mainly revealed itself in a decline of foraging areas for many wader species. Consequently, many birds dependent on these intertidal flats, fail to find enough food in the limited period between floods and will leave the

Oosterschelde. The foraging function depends on the size of the intertidal area, the emersion time, i.e. the time the intertidal area is not covered with water and accessible for foraging, and the food availability and quality (Van der Werf et al., 2019). These aspects are all influenced by the sand deficit.

1.3.2 Management of nature conservation of the Oosterschelde

The Oosterschelde is an EU Bird Directive designated area for 45 bird species (Sovon, 2020). The Dutch government has the responsibility to maintain the conservation objectives for these birds. Measures that have to be taken in order to realize the conservation objectives are presented in the 'Management plan 2016-2022 of the Oosterschelde' (Ministerie van Infrastructuur en Milieu: Rijkswaterstaat, 2016). For the conservation objectives for birds, a target number is formulated, which is indicative of the desired carrying capacity of the area (Ministerie van Infrastructuur en Milieu: Rijkswaterstaat, 2016). For most wading birds, this number is assessed 10% lower than the means of 1999-2003 because of the sand deficit problem, which is not expected to be solved in the near future (Ministerie van Landbouw Natuur en Voedselkwaliteit, 2009).

Besides nature conservation, major functions of the Oosterschelde are professional shipping and fishery (Ministerie van Infrastructuur en Milieu: Rijkswaterstaat, 2016). Recreation is also experiencing significant growth. The Province of Zeeland is a popular tourist destination and inviting for recreational activities. Zeeland had the highest increase of foreign tourists in the Netherlands in the year 2013/2014 (De Bruijn et al., 2015, p. 96). For activities that are expected to negatively affect conservation objectives, a permit could be required, or mitigating measures should be taken (Ministerie van Infrastructuur en Milieu: Rijkswaterstaat, 2016).

1.3.3 The Oesterdam area: nature and human activities

Because of the decrease in tidal velocity in the Oosterschelde, it was decided to reduce the Oosterschelde area, aiming at raising the water level. The Oosterschelde was to be divided into compartments by dams. The compartment dam 'Oesterdam', located in the easternmost part, reduces the Oosterschelde area, and separates salt water from fresh water, which is important for specific nature conservation goals (Rijkswaterstaat, 2019).

In 2007 the project 'Investigation Sand Demand' was started to investigate whether the negative effects of the sand deficit problem in the Oosterschelde, like morphological changes, wave load on dykes, reduced biodiversity, and reduced ecosystem functionality, could be mitigated by sand nourishments (M. P. Boersema et al., 2018). The Oesterdam sand nourishment was the largest: in November 2013 a total of 350.000 m^3 of sand was placed at the tidal flat. In addition, oyster reefs were constructed in the same area to prevent erosion of the sand nourishment sites. The sand nourishment near the Oesterdam should has a life span of 20–30 years, and is considered to be a sustainable solution to the problem stated (M. Boersema, Van der Werf, Van Zanten, & Ysebaert, 2017). There was

quick recovery of benthic macrofauna (Walles, Van den Brink, Boersema, & Ysebaert, 2018), but unfortunately, the sand nourishment at the Oesterdam area created, unintended, an attractive site for recreation during low tide (Bijl, Hazel, & Derriks, 2018), as it is now used as a beach for recreational activities like walking, dog-walking, swimming, bait digging, horse riding, wind surfing and kitesurfing. Especially kitesurfing is expanding in the Oesterdam area (Bijl et al., 2018; M. P. Boersema et al., 2018). It is unknown what the exact impact of these human activities is on bird conservation under the influence of the sand deficit problem.

1.3.4 Vulnerable birds in the Oesterdam area

The shelduck (bergeend, *tadorna tadorna*), the goldeneye (brilduiker, *bucephala clangula*) and the wading bird oystercatcher (scholekster, *haematopus ostralegus*) (Figure 2) belong to the vulnerable birds for which conservation objectives are difficult to achieve, at present or in the future, according to the 'Management plan 2016-2022' (Ministerie van Infrastructuur en Milieu | Rijkswaterstaat, 2016). The shelduck depends on low tide foraging areas, which are threatened by the sand deficit problem on one hand, and by recreational activities on the other (Bijl et al., 2018). The fluctuating trend of the shelduck in the Oosterschelde raises the question how this trend is related to the sand deficit problem and to the increase in recreational activities. According to the management plan the kitesurfing area and surroundings along the Oesterdam are mainly used by ducks such as goldeneye, especially in the winter half of the year (Ministerie van Infrastructuur en Milieu | Rijkswaterstaat, 2016, p. 63). Since the goldeneye is an open-water bird it might in particular be disturbed by water recreation like kitesurfing. Therefore, it would be interesting to get an insight in the relationship between human activities and the goldeneye. The oystercatcher also depends on the low tide foraging areas, and is vulnerable to recreation (Henkens, Broekmeyer, Schotman, Goossen, & Pouwels, 2012; Krijgsveld, Smits, & Van der Winden, 2008; Ministerie van Infrastructuur en Milieu | Rijkswaterstaat, 2016). Since this bird is present in the Oesterdam area all year round, the oystercatcher might be influenced by all factors affecting the quality of the habitat.

Figure 2: *Vulnerable birds in the Oesterdam area: a) Shelduck; b) Goldeneye; c) Oystercatcher.*

1.4 Aim and research questions

In the scope of a revision of the management plan for the Oosterschelde, different scenarios for human activities in the Oesterdam area were elaborated by Rijkswaterstaat and the Province of Zeeland (see Table AII-1)[2] to support decision-making concerning nature conservation. In this study human activities are recreational. This thesis aims to get an insight into the interaction between recreation, vulnerable birds and sand dynamics (sand deficit and sand nourishments), and how this complicates Natura 2000 conservation measures.

The main research question is:

'How does the interaction between vulnerable birds, recreation, and sand dynamics complicate Natura 2000 conservation measures of the Oesterdam area?'

Sub-questions:

Sub-questions are formulated to support answering the main research question:

1. How can vulnerable birds and recreational activities in the Oesterdam area in the current situation be described and presented?
2. Which bottlenecks exist in the assessment of disturbance effects on vulnerable birds for different nature management measures for the Oesterdam area?
    a. Which disturbance effects of recreation on vulnerable birds can be expected?
    b. Which uncertainties play a role in judging the disturbance effects of recreational activities on vulnerable birds?
    c. What role do sand dynamics play in the disturbance effects of recreation?

1.5 Outline

This chapter provides an overview of the research topic concerning disturbance effects of recreational activities on birds in the Oesterdam area, including aim and research questions. Chapter 2 discusses the theoretical framework: disturbance of vulnerable birds by recreation and sand dynamics, and the uncertainties associated with it. Chapter 3 will elaborate on the different methods of looking for answers to the research questions. In Chapter 4 the results are presented. Chapter 5 gives an explanation of the current legislation. Chapter 6, the conclusion, elaborates on the complexity of Natura 2000 conservation measures. Chapter 7 takes a critical look at the concepts of disturbance and vulnerability, at zoning as a conservation measure and at the Delphi method. Finally, recommendations will be made for further research and policy in Chapter 8.

[2] Table AII-1 means *Appendix II Table 1*

2 Theoretical framework

This chapter describes the concepts of *disturbance of vulnerable birds by recreational activities*, and the *effects of sand dynamics*. Different types of *uncertainties*, complicating deciding on conservation measures, are explained.

2.1 Disturbance of birds by recreation and the impact of sand dynamics

2.1.1 Disturbance effects of recreational activities

Nature based recreational activities can have a range of disturbance effects on birds, which can alter the physiology or behaviour of the birds (Steven, Pickering, & Guy Castley, 2011). Disturbance effects on birds are presented in Figure 3.

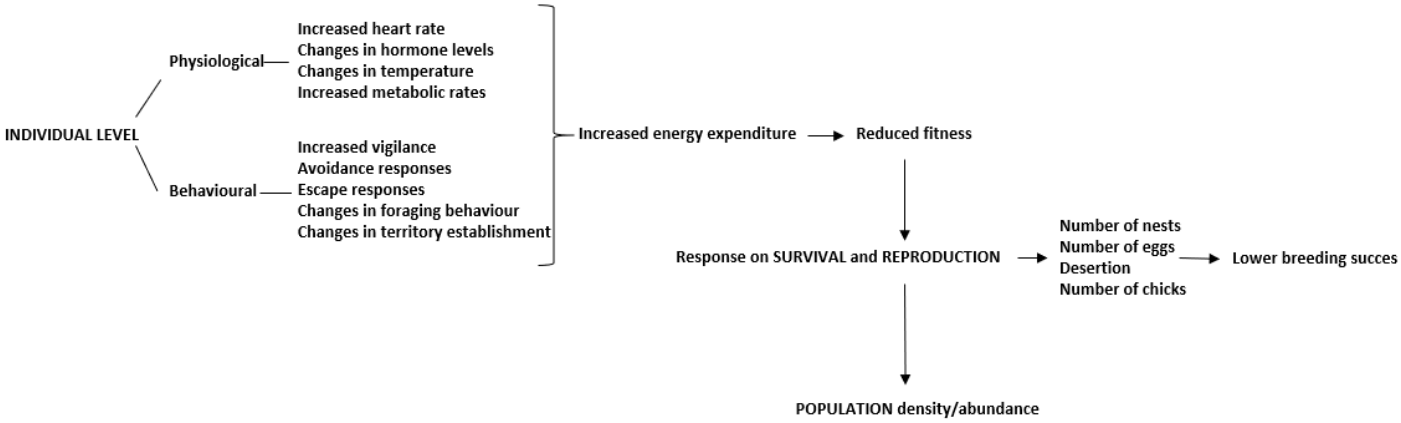


Figure 3: *Disturbance effects on birds, at individual and population level.*

Steven et al. (2011) investigated the effect of non-motorized nature based recreation on birds by reviewing recreation ecology literature. The importance of a negative disturbance effect depends on indicators related to the activity, like intensity of disturbance, duration and frequency, predictability of behaviour of the source of disturbance, type of source of disturbance (noise production, speed, and visibility), and distance between bird and source of disturbance (Krijgsveld et al., 2008; Steven et al., 2011). Additionally, there could be differences in individual versus population level responses. Furthermore, the real effects depend on the species in question, age, sex, size, condition, reproductive status, availability of alternative habitat and disturbance history (Steven et al., 2011).

A report by Ens et al. (2017) shows that the most severe disturbance effects of recreational activities on birds in the Wadden Sea originated from surfers, including kitesurfers. Effects of recreation on birds determined in studies are often specific for the situation investigated and could therefore not be extrapolated from the short to the long term, to other species or other habitats. This implies that every specific situation should be investigated to know if effects of recreation are negative, neutral or

positive. The literature gives several definitions for disturbance and disturbance effects (Bateman & Fleming, 2017; Jonkvorst & Van den Boogaard, 2020; Krijgsveld et al., 2008; Wallace, 2016). I use the definition of Jonkvorst and Van den Boogaard (2020, p. 52) in this thesis: *Disturbance is defined as the reaction of a bird under the influence of human presence, in the broadest sense of the word, as a result of which it does not continue its natural pattern of behaviour. It can be expressed in changes in behaviour and physiology, in bird numbers and in reproductive success or survival, and can therefore affect population size of a species.*

2.1.2 Effects of sand dynamics

The term sand dynamics is used in this thesis to refer to the dynamic process of sand deficit (the disappearance of intertidal flats, salt marshes and mud flats) in the Oosterschelde, and the slowing down of this sand deficit problem by sand nourishments. Sand nourishments are considered as one of the most important methods for conservation of the natural habitats of wader species, aiming at recovery of foraging areas for birds (De Ronde, Mulder, Van Duren, & Ysebaert, 2013). Both sand deficit and sand nourishment might influence the impact of human recreation on birds. The effect of sand nourishments can be complicated by disturbance caused by increased recreation activity.

2.2 Knowledge uncertainties in nature conservation

Uncertainty is inherent to decision-making in nature conservation and is described as '*the situation in which there is not a unique and complete understanding of the system to be managed*' (Brugnach, Dewulf, Pahl-Wostl, & Taillieu, 2008, p. 4). Uncertainties are often perceived as something that can be eliminated by more research. However, some types of uncertainty can even increase by more research, as this makes the problem more complex (Van Asselt & Vos, 2007). Three different types of uncertainties can be made: *incomplete knowledge*, *unpredictability* and *ambiguity* (Brugnach et al., 2008; Floor, Van Koppen, & Van Tatenhove, 2016; Ounanian et al., 2018; Van den Hoek, 2014).

2.2.1 Incomplete knowledge

'Incomplete knowledge' is a type of uncertainty which refers to *not knowing enough*. Incomplete knowledge means uncertainty due to lack of specific knowledge, data imprecision or approximations (Brugnach et al., 2008). In addition, data can be of insufficient quality to provide reliable knowledge of the system (Ounanian et al., 2018). Collecting more or better data could reduce this kind of uncertainty and improves understanding of the system to be managed. More research could be helpful in this case, since this will improve understanding of the situation (Floor, 2018). Data about recreation ecology is also still limited for many locations, habitat types, bird groups and types of recreational activities (Steven et al., 2011), meaning incomplete knowledge. Increasing this knowledge is advisable, since human activities could have a range of negative effects on nature (Beunen, 2006; Steven et al., 2011).

2.2.2 Unpredictability

Another type of uncertainty which is determined by not knowing enough is 'unpredictability', which implies that knowledge could be unknowable because it is related to very complex systems (Brugnach et al., 2008; Ounanian et al., 2018). Unpredictability means uncertainty due to unpredictable behaviour of, for example, natural processes, human beings or social processes and their interactions (Brugnach et al., 2008). This type of uncertainty also implies that it must be accepted that not every phenomenon is predictable. Doing more research cannot reduce this kind of uncertainty. Concerning the problem at the Oesterdam, uncertainties might persist regarding the ecological effects of sand nourishments: uncertainties could be both attributed to incomplete knowledge since sand nourishments in the Delta Waters are still under investigation, and to unpredictability due to the complexity of the natural system and the variety of ecological and human factors. Furthermore, it is not always predictable if a disturbance effect of human activities is positive, negative or neutral since effects may vary between the short and the long term (Steven et al., 2011).

2.2.3 Ambiguity

Ambiguity is uncertainty of a different type, as it is not about what we do not or cannot know (Van den Hoek, Brugnach, Mulder, & Hoekstra, 2014). It originates from *knowing differently* due to the diversity of possible interpretations or conflicting views of a specific situation (Brugnach et al., 2008; Van den Hoek et al., 2014). This could influence decision-making on nature conservation (Floor et al., 2016; Tuinstra, Ragas, & Halffman, 2019). As a consequence several discourses can arise about the scientific certainty concerning the ecological complexity, the social aspects of policy objectives and thus the interpretation of legal terms (Henkens et al., 2012). For example, it is debatable whether an activity leads to a *significant* effect: there are multiple interpretations based on context and shaped by legislation making value judgement an integral part of significance determination (Floor et al., 2016; Henkens et al., 2012). The importance of the social-economic framework in determining significance is also stated by Ehrlich and Ross (Ehrlich & Ross, 2015, p. 90): '*The level of significance for each effect would properly be determined based on ecological, social and financial considerations and would be based on the values of society.'*

Ambiguity could be used to put the problem and its analysis into perspective, making it possible to see which aspects of the problem should be considered most relevant (Brugnach et al., 2008). Different interpretations concerning legislation in nature conservation could lead to different ways of implementing directives, like the Birds and Habitats Directive, in practice by authorities (Beunen, 2006). In this study, various stakeholders could approach the disturbance effects on vulnerable birds due to recreational activities described, differently.

3 Methods

3.1 Research approach

This research adopted a mixed methods strategy to answer the research questions. Information from the literature study (3.2.1) was used to formulate the questions for the semi-structured interviews (3.2.4) and the statements for the Delphi study (3.2.5). Information originating from the interviews was also used to create statements for the Delphi study. Eventually, the data from the different methods will be combined to try to answer the research questions. In this study, scenarios (Table AII-1) are used to determine the impact of human activities on vulnerable birds for different situations and to discover uncertainties and bottlenecks related to conservation measures upon this interaction.

3.2 Data collection

3.2.1 Literature study

Existing documents, like the management plan of the Oosterschelde, the 'Natura 2000 doelendocument', the Natura 2000 designation decisions, background information on the Oesterdam area and scientific publications on the interaction between humans and nature in general, were studied to get an insight into recreational activities in the current situation, related disturbance effects on vulnerable birds, and the implementation of conservation measures in the Oesterdam area. Information on the vulnerability of the bird species was collected: disturbance distances, most vulnerable period of the bird species, and the likelihood of effects at population level. This is presented as qualitative descriptions in a table. In addition, effects of sand dynamics on vulnerable birds are explored in literature.

3.2.2 Bird counting data

Data of bird counts of shelduck, goldeneye and oystercatcher in the Oesterdam area from 2008-2017 was requested from Deltamilieu. This gives an insight into trends of bird counts. This will be presented in graphs for each bird species. Additional websites were used for bird counting data in the Oesterdam area (Provincie Zeeland, n.y.; Rijkswaterstaat, n.y.). Maps are used to gain more insight into the differences between the spatial distribution of the birds per season. Data from Sovon (Sovon, 2020) was used to compare annual averages of the Oesterdam with the annual averages of the Oosterschelde and of the Netherlands.

3.2.3 Observations

Two bird counts were attended, and the results were used (Table AIV-1) to get insight in how the Oesterdam area is used by the birds (shelduck, goldeneye and oystercatcher) during high tide. The bird

counts were carried out by an expert from Deltamilieu, and are among the regular high tide counts commissioned by Rijkswaterstaat.

Besides observations of bird counts, eight visits to the Oesterdam area served to observe recreational activities first hand. These visits lasted about 20-30 minutes and the observations were recorded as accurately as possible (Table AIV-2): which kind of recreational activities are taking place? Do recreants enter the intertidal zones? What are the weather conditions like, related to the kind of recreation taking place? The observation data could be considered a reflection of the current situation.

3.2.4 Semi-structured interviews

Stakeholders who are professionally concerned with the problems in the Oesterdam area, were invited for individual face-to-face semi-structured interviews with open-ended questions. The purpose was to get an insight into perspectives of stakeholders on the area, on decision-making, recreational activities, birds, sand nourishments and interactions between all these factors currently occurring in the Oesterdam area. The interview questions were related to the research questions, like:

- To what extent are vulnerable bird species in the Oesterdam area influenced by recreants?
- How realistic are conservation objectives for birds in view of the sand deficit problem?
- How can sand nourishments best be carried out in favour of conservation objectives, taking into account the attractiveness of the area for recreation?
- What are the bottlenecks and uncertainties for different scenarios or conservation measures?

Stakeholders from different organizations were approached in order to acquire a broad view of the issue. In total 11 stakeholders (Table AIII-1) participated in the interviews from June 12th 2019 till February 13th 2020. Interviews were recorded and transcribed afterwards. The length of time varied between one and two hours. After transcription, the interview data were categorized and summarized. Relevant interview fragments are listed in Table AIV-4.

The interviewees were also asked to elaborate on different scenarios for recreational activities in the Oesterdam area (Table AII-1). Scenarios used in this study were worked out by Rijkswaterstaat and the Province of Zeeland to assess which policy would be the most favourable solution in a situation in which conservation values, recreational values and safety values conflict at the Oesterdam. The safety risk related to kitesurfing relates to the busy road directly adjacent to the kitesurfing location, lack of any safety margin towards the stony hard surface and dike slope when launching the kite, and the hard covering of the dam. The different scenarios describe the situation for which the management plan was aiming, and three different situations which are to be expected. Kitesurfing is used as point of concern, but other recreational activities are mentioned as well. In these scenarios different measures were suggested to manage recreational activities in the Oesterdam area, which each would have a

different impact on nature conservation. Interviewees were asked to elaborate on probability of occurrence, bottlenecks and uncertainties of the current situation and the different scenarios.

3.2.5 Delphi study

The Delphi-method is a method developed to enable a group of individuals to explore or achieve consensus on disputed topics. It comprises two or more rounds of questionnaires, each followed by a summary of responses and anonymous feedback to the participants (Mukherjee et al., 2015). The Delphi-method was used in this study to get more insight into different perspectives of ecological experts regarding the interaction between recreational activities, sand nourishments and vulnerable birds in the Oesterdam area. The invited experts are familiar with the Oesterdam area or have experience with, or knowledge of, other issues concerning human-bird interaction. Point of interest was whether experts would change their answer based on different explanations of other participants in a next round. In total 26 statements were formulated, divided into categories, related to the research questions. The differences between the scenarios were used as much as possible in the questionnaire, to reflect experts' opinions on the scenarios.

Twenty-one invited experts were given a two-week period to respond. The first round of Delphi started with a set of open-ended questions and a questionnaire with statements. The questionnaire was a quantitative survey using a five-point Likert-scale (1, strongly disagree; 2, disagree; 3, neither disagree nor agree; 4, agree; 5, strongly agree) (Donohoe, 2011; Iqbal & Pipon-Young, 2009). The option 'I don't know' was added to this five-point scale. As criterium for consensus a 70% percentage agreement was used. Statements that did not achieve consensus were included in the second-round questionnaire.

In the second round of Delphi, the participant's own answer was given and the variety of answers on the Likert scale (strongly disagree - strongly agree) was visualized in a pie chart. The participants received information about the statements that had already reached consensus. For the statements that did not reach consensus, participants could consider their scores in the light of the group response and, if preferred, change any of their responses. The explanations of the participants were used to give arguments to the statement. This gave the participants the possibility to react to different aspects of the statement, which would make interpretation less difficult. These arguments could also be responded to on the 1-5 Likert scale and provided with an explanation. Two statements were reformulated and new statements were added in this round based on feedback of the participants.

Initially, the response was 43% (9 respondents) in the first round. One participant had distributed the list among colleagues so that an extra list was sent back (filled in by 2 respondents). In total, 10 questionnaires could be analysed. Participating experts are listed in Table AIII-1. After the questionnaire of the second round was sent to the participants, a last questionnaire from the first round returned. The answers to this questionnaire were therefore not included in the feedback to the

participants. The results shown in this thesis are however the result of 11 questionnaires. This last questionnaire was filled in by three people. In the end, 52% of the invitees responded in the first round. Sometimes two answers were indicated on the Likert scale. These answers were not included in quantitative analysis, but the explanations were used qualitatively. After round 1, there was consensus (70% agreement) on 11 statements with 10 respondents, and there was consensus on 10 statements including the last participant (11 respondents). It was decided to consider the answers as 'strongly disagree' and 'disagree' the same, as well as 'strongly agree' and 'agree'. Only 8 participants from the first round also participated in the second round (73%). Participants who filled a list in together are considered one participant. Not all questionnaires were fully completed. In the analysis, percentages of the completed answers were calculated, in other words, missing values were not considered. In most cases, the same answer was given in both rounds. Only one statement that did not reach consensus in the first round, achieved consensus in the second round. One of the reformulated statements and one added statement reached consensus in the second round.

The responses were analysed using qualitative and quantitative measures. Qualitatively, the responses on statements were categorized and reduced to major themes. Quantitatively, percentages of the answers are presented in a pie chart (Table AIV-7) (Donohoe, 2011; Iqbal & Pipon-Young, 2009; Mukherjee et al., 2015). For this purpose, IBM SPSS Statistics version 26 is used.

3.2.6 Overview of used methods

Next table shows an overview of the methods used.

Table 1: *Overview of methods used in this thesis*

Method	Characteristics/sources	Results
Literature study	- Documents and websites like Management plan of the Oosterschelde, the 'Natura 2000 doelendocument', the 'Natura 2000 designation decisions', background information on the Oesterdam area - Scientific publications on the interaction between humans and nature in general	Table 2 Figure 8, 10, 12
Bird counts	- Deltamilieu/Sovon/Province of Zeeland/Rijkswaterstaat	Figure 4, 5, 6
Observations	- Bird counts (2x) - Recreational activities (8x)	Figure 7 Table AIV-1, AIV-2
Semi struc. interviews	- 11 Stakeholders, who are professionally concerned with the problems in the Oesterdam area; X = interviewee X	Table 3, 4 Table AIII-1, AIV-4, AIV-5
Delphi method	- 14 Ecological experts - XX = Delphi participant XX	Table 3, 4 Figure 9, 11 Table AIII-1, AIV-6, AIV-7

4 Results

This chapter deals with the selected vulnerable birds and recreational activities in the Oesterdam area. In order to identify bottlenecks that may arise deciding on conservation measures, it is recommended to first gain an insight into the disturbance effects of recreation on birds, into uncertainties regarding to this interaction, and into the influence of sand dynamics. Finally, issues associated with conservation measures as such are discussed.

4.1 The Oesterdam area: birds and recreational activities

The 'Kom van de Oosterschelde' is one of the best foraging areas of the Oosterschelde for birds. Since this area is easily accessible via the Oesterdam and its associated parallel road, there are also many recreational activities. From the start of the Oesterdam sand nourishment, it was acknowledged that recreational activities could expand, partly due to the assignation of a kitesurf site. However, the current recreational growth was unexpected (H)[3].

4.1.1 Characteristics of vulnerable birds in the Oesterdam area

The vulnerability of the shelduck, goldeneye and oystercatcher has been studied in more detail in the literature. None of these three species breed or moult in the Oesterdam area. Therefore, winter is the most vulnerable season for these birds in this area: this is the period when birds need more energy but at the same time, less benthos is available (H), which can affect their energy balance negatively. Characteristics of the shelduck, goldeneye and oystercatcher are specified in Table 2. The degree of sensitivity to disturbance varies from species to species and may manifest, for example, in flight initiation distances. The disturbance distances known in the literature (minimum and maximum) are listed per species in the table. Figure 6 shows that both oystercatchers and shelducks forage within the maximum disturbance distance of the kitesurfing area, especially in winter. Based on this, disturbance effects on these birds are to be expected.

Shelduck

Although mentioned in the management plan as a vulnerable bird, the shelduck does not appear to be endangered at the moment, and its trend in the Netherlands and in the Oosterschelde is positive (increase <5%) (Sovon, 2020). The conservation objective of the shelduck is formulated in the management plan as 'maintain number (2900 birds) and quality of the habitat' (Ministerie van Infrastructuur en Milieu: Rijkswaterstaat, 2016). It mentions sand deficit as a bottleneck. The bird is slightly vulnerable to recreation (Henkens et al., 2012).

[3] H means interviewee H. See also Table 1 in Chapter 3.

Goldeneye

The goldeneye is on the Red List of Birds in the 'near threatened' category (Van Kleunen, Foppen, & Van Turnhout, 2017). Its trend is negative, with a decrease of less than 5% in the Netherlands and a decrease of more than 5% in the Oosterschelde (Sovon, 2020). The conservation objective of the goldeneye is formulated as 'maintain number (680 birds) and quality of the habitat' (Ministerie van Infrastructuur en Milieu: Rijkswaterstaat, 2016). Its bottleneck is unknown and the bird is relatively vulnerable to recreation (Henkens et al., 2012). Delphi participant BB[4] indicates that the 'Kom van de Oosterschelde' in particular is a very important area for this species.

Table 2: *Characteristics of shelduck, goldeneye and oystercatcher and their vulnerability in the Oesterdam area.*

Bird	Priority for active protection measures*	Trend (last 10 seasons)**		Conservation objective Oosterschelde ***	Bottleneck ***	Indication vulnerability for recreation ****	Disturbance distance (min-max) *****	Population effects *****
		Oosterschelde	NL					
Shelduck	Not threatened at the moment	Sign. increase <5%	Sign. increase <5%	Maintain number and quality of habitat with the capacity to carry a population averaging 2,900 birds (seasonal average).	Sand deficit problem	Slightly vulnerable	99-700 m	Unknown
Goldeneye	Red list (near threatened)	Sign. decrease >5%	Sign. decrease <5%	Maintain number and quality of habitat with the capacity to carry a population averaging 680 birds (seasonal average).	Unknown	Relatively vulnerable	200-1000 m	Indications of possible effects.
Oystercatcher	Orange list (warning for red list)	Sign. decrease <5%	Sign. decrease <5%	Maintain number and quality of habitat with the capacity to carry a population averaging 24,000 birds (seasonal average).	Sand deficit problem	Relatively vulnerable	10-400 m (land/water); 150-3150 m (air)	Possible some effects due to high recreational pressure in coastal areas

*(Van Kleunen et al., 2017); **(Sovon, 2020); ***(Ministerie van Infrastructuur en Milieu: Rijkswaterstaat, 2016); ****(Henkens et al., 2012); *****(Krijgsveld et al., 2008)

Oystercatcher

The oystercatcher is on the Orange List, warning it may get onto the Red List (Van Kleunen et al., 2017). The bird shows a negative trend, with a decrease of less than 5%, both in the Netherlands and in the

[4] BB means Delphi participant BB. See also Table 1 in Chapter 3.

Oosterschelde (Sovon, 2020). The real reason for the unfavourable conservation status of the population is unknown. It may be a local phenomenon or be caused by external factors. The conservation objective for the oystercatcher is formulated as 'maintain number (24.000 birds) and quality of the habitat' (Ministerie van Infrastructuur en Milieu: Rijkswaterstaat, 2016). Sand deficit is seen as its biggest bottleneck. The bird is relatively vulnerable for recreation (Henkens et al., 2012). Figure 4 shows the trends of the birds in the Oesterdam area per season over the last 10 years (data from Deltamilieu). The relatively positive trend of the oystercatcher over the last 5 years is striking. This is the period of the sand nourishment in which the recreational pressure also increased. Additional factors are unknown.

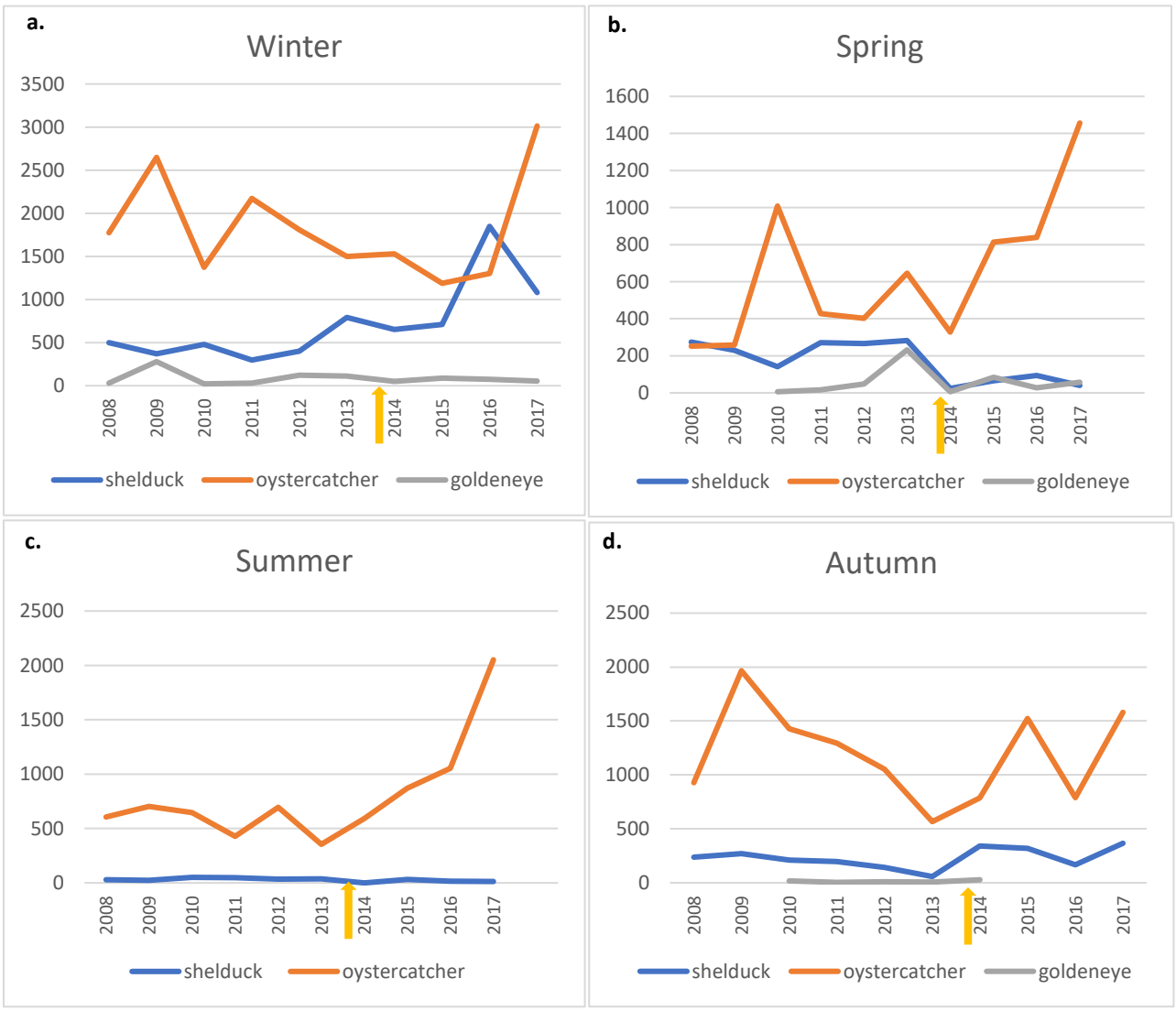


Figure 4: *Trends of shelduck, goldeneye and oystercatcher per season over the last 10 years in the Oesterdam area based on high tide counting data. a) Winter is December, January and February; b) Spring is March, April and May; c) Summer is June, July and August; and d) Autumn is September, October and November. The goldeneye is only present in the Oesterdam area in the period November-March, so with regard to the goldeneye, Autumn is limited to November, and Spring is limited to March. The Oesterdam sand nourishment took place in November 2013, indicated with a yellow arrow.*

In order to determine the relative importance of the Oesterdam area for the birds, a comparison was made with the Oosterschelde as a whole and with the Netherlands. Figure 5 shows the annual averages for shelduck, goldeneye and oystercatcher and the relative increase or decrease.

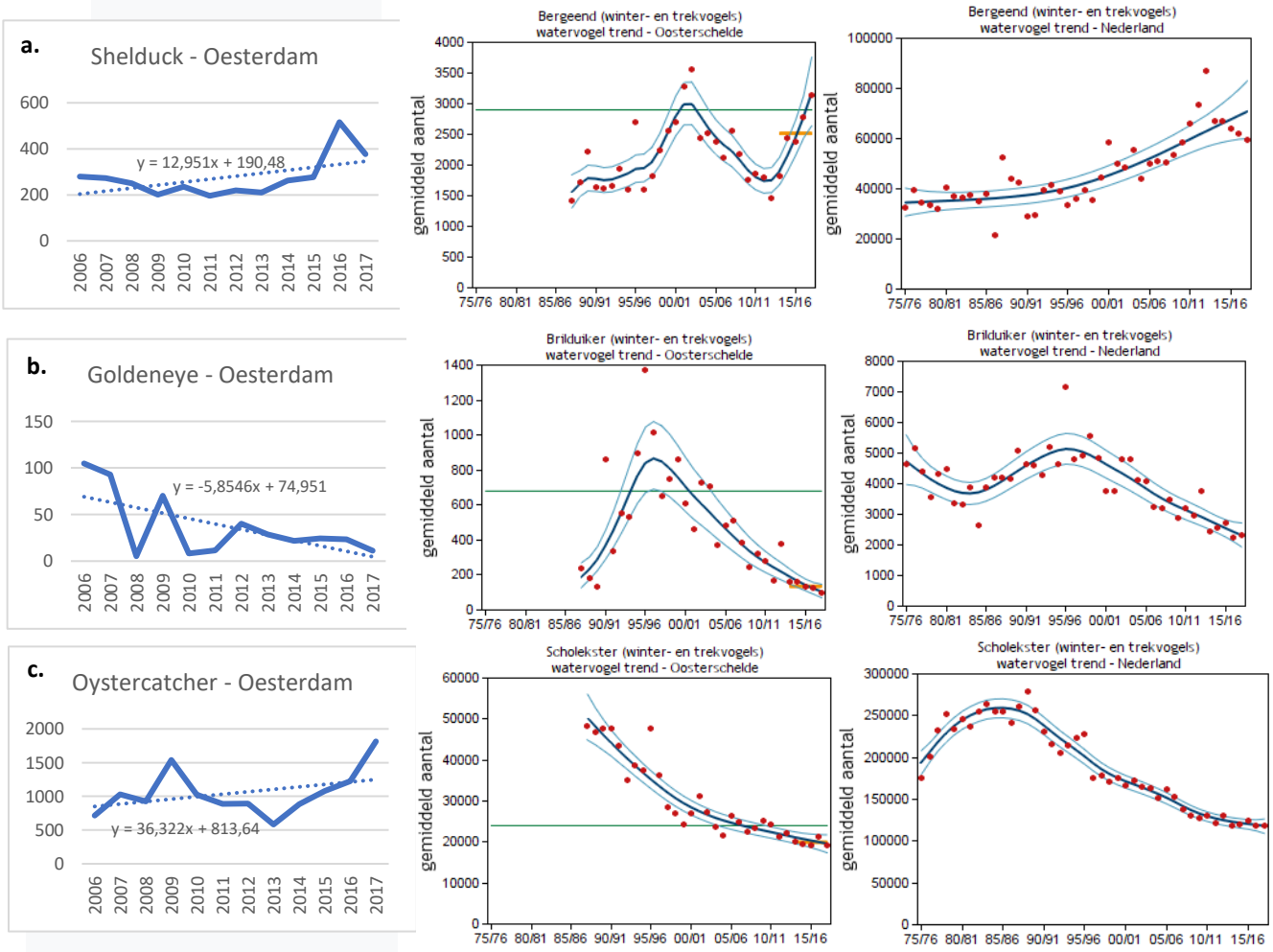


Figure 5: *Average number of birds per year (2006-2017) in the Oesterdam area (data from Deltamilieu); and the Oosterschelde and the Netherlands(1975-2017) (Sovon, 2020): the seasonal average (red points), the trend line (dark colored line) and the 95% confidence interval of the trend line (light colored line) are shown. The conservation goal for the species is shown in green. a) Shelduck: showing an increase of 6.8% in the Oesterdam area, an increase of <5% in the Oosterschelde (last 12 seasons), and an increase of <5% in the Netherlands (last 12 seasons); b) Goldeneye: showing a decrease of 7.8% in the Oesterdam area, a decrease of >5% in the Oosterschelde (last 12 seasons), and a decrease of <5% in the Netherlands (last 12 seasons); c) Oystercatcher: showing an increase of 4.5% in the Oesterdam area, a decrease of <5% in the Oosterschelde (last 12 seasons), and a decrease of <5% in the Netherlands (last 12 seasons).*

In the last twelve seasons the trend of the shelduck is more positive in the Oesterdam area than in the Oosterschelde and in the Netherlands. The goldeneye shows a decline that could be comparable to the decline in the Oosterschelde and is stronger than the decline in the Netherlands. The oystercatcher trend is positive in the Oesterdam area, while it is negative in the Oosterschelde and in the Netherlands. The trends of shelduck and oystercatcher show that the Oesterdam area appears to be relatively important for these birds, despite the increased recreation. This positive effect could be explained by the sand nourishment that was carried out in 2013, because from that year onwards the number of birds increased.

It should be noted that from 2013 every counting area will no longer be counted monthly. The Oesterdam area consists of two counting areas of which only one is counted every month, and the area only in January, February, May, August, November and December. The actual bird numbers could therefore be higher from 2013 than the graphs in Figure 4 and 5 indicate.

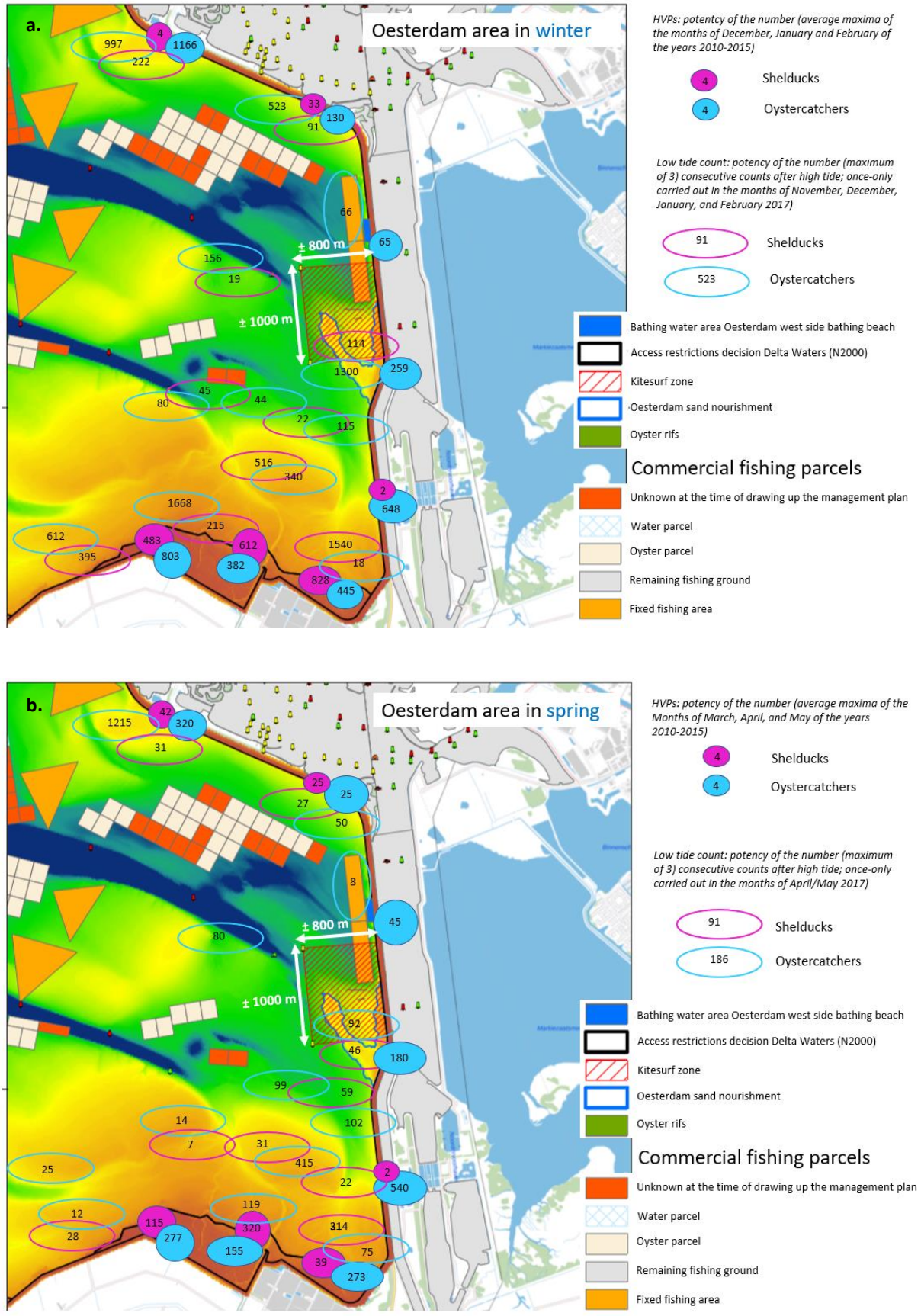
In Table AIV-1 some observational data from two bird counts are shown. These counts show a lower number of shelducks than the counting data in Figure 4d, but a considerably higher number of oystercatchers. This is in line with the positive trend in the number of oystercatchers at the Oesterdam.

4.1.2 Characteristics of recreational activities in the Oesterdam area

The report by Bijl et al. (2018) describes a brief investigation into the use of the Oesterdam area by recreants in the period July 2018 till October 2018. It shows that the Oesterdam has an important recreational function for the region, to which thousands of recreants come every year. The observations show that >40% of the visitors are roadside recreants (like sunbathing and swimming). Kitesurfers make up 31% of the recreants. Approximately 10% of the visitors walk, almost two-thirds of them with a dog. About 10% of the visitors were cyclists. Only a few came to fish, dig for bait or came bird-watching. The recreant's stay varies according to activity: windsurfers stay for over 4 hours, kitesurfers for 3 hours and 40 minutes, walkers for 1.5 hours and cyclists for 2 hours. In addition to their presence on the dam itself, one third of the recreants also visit the intertidal flats in front of the southern part of the Oesterdam. Although the majority (about 86%) stays inside the boundaries of the designated kitesurf zone, almost half of the kitesurfers admitted to surf sometimes outside these boundaries. Around 20% of the wind and kitesurfers enter the dry intertidal areas. Since the research by Bijl et al. (2018) was limited to a specific period, and no other data on recreational use of the Oesterdam area is available, data has been collected by my own observations. These are shown in Table AIV-2. Hardly any birds were present at these moments. Table AIV-3 shows additional data of kitesurfers by the RUD Zeeland (regional executive service of Zeeland). Observations by RUD were only made on working days. These observations showed the same activities as Bijl et al. (2018), where the number of kitesurfers understandably depended on wind direction and wind force.

4.1.3 Spatial distribution of birds and human activities in the Oesterdam area

The possible distribution of the birds in the Oesterdam area is mapped per season. An existing map of the area was used for this purpose (Schep, 2018), to which bird counts were added (Provincie Zeeland, n.y.; Rijkswaterstaat, n.y.). This is shown in Figure 6. Bird counts refer to the shelduck and the oystercatcher. No data was available for the goldeneye in these sources. These maps give an indication of the number of birds that *may* be present in a specific subarea per season, and of locations where human activities *may* take place. The high tide counts indicate the average seasonal maximum per high tide roost (HVP; *hoogwatervluchtplaats* in Dutch) in the counting years 2010-2015.


a.
Oesterdam area in winter
HVPs: potentcy of the number (average maxima of the months of December, January and February of the years 2010-2015)
Shelducks
Oystercatchers
Low tide count: potency of the number (maximum of 3) consecutive counts after high tide; once-only carried out in the months of November, December, January, and February 2017)
Shelducks
Oystercatchers
± 800 m
± 1000 m
Bathing water area Oesterdam west side bathing beach
Access restrictions decision Delta Waters (N2000)
Kitesurf zone
Oesterdam sand nourishment
Oyster rifs
Commercial fishing parcels
Unknown at the time of drawing up the management plan
Water parcel
Oyster parcel
Remaining fishing ground
Fixed fishing area
b.
Oesterdam area in spring
HVPs: potency of the number (average maxima of the Months of March, April, and May of the years 2010-2015)
Shelducks
Oystercatchers
Low tide count: potency of the number (maximum of 3) consecutive counts after high tide; once-only carried out in the months of April/May 2017)
Shelducks
Oystercatchers
± 800 m
± 1000 m
Bathing water area Oesterdam west side bathing beach
Access restrictions decision Delta Waters (N2000)
Kitesurf zone
Oesterdam sand nourishment
Oyster rifs
Commercial fishing parcels
Unknown at the time of drawing up the management plan
Water parcel
Oyster parcel
Remaining fishing ground
Fixed fishing area

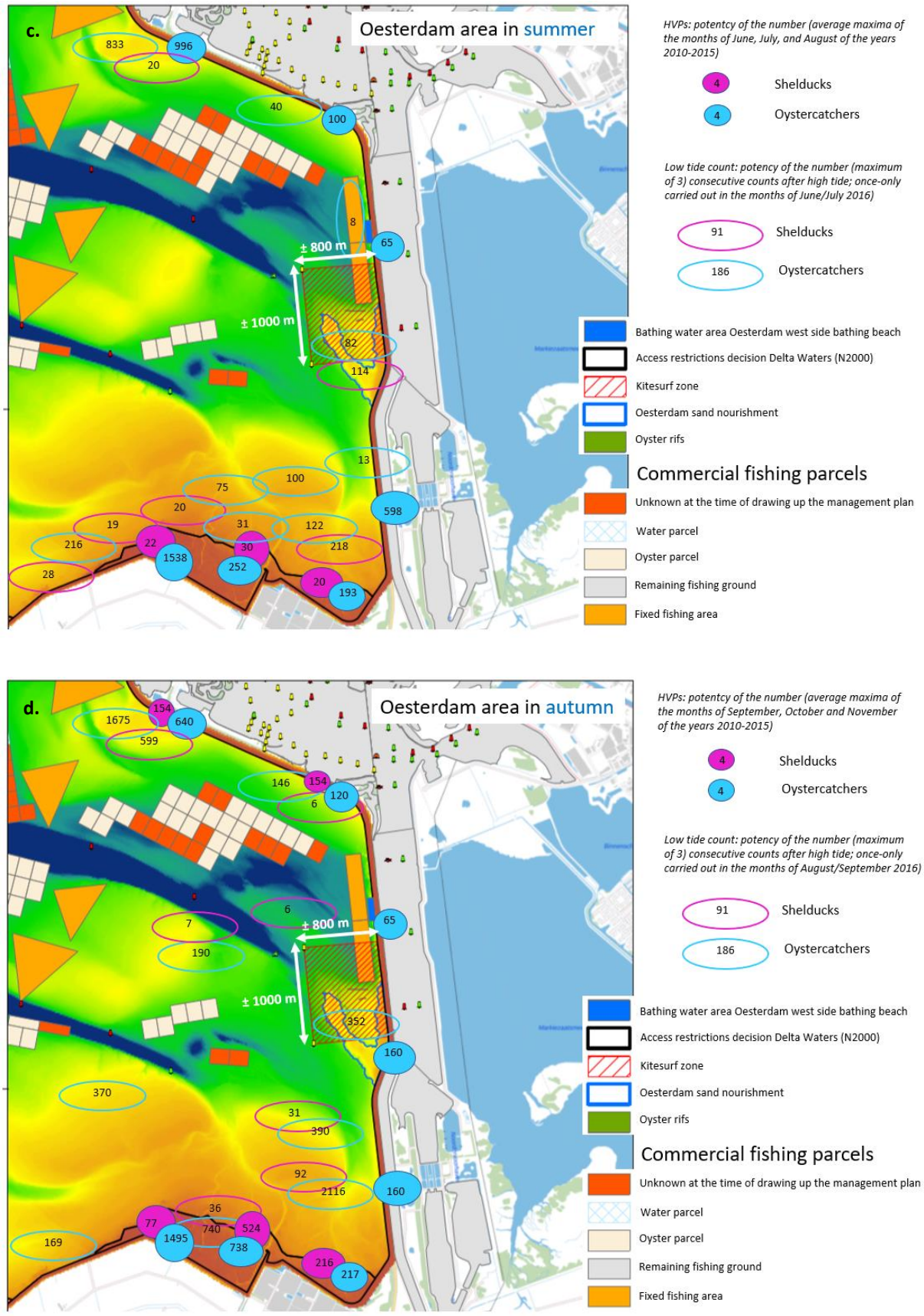


Figure 6: *Potential distribution of the birds per season (a=winter, b=spring, c=summer, d=autumn), and locations of human activities (Provincie Zeeland, n.y.; Rijkswaterstaat, n.y.; Schep, 2018).*

Because the same individual birds often use more than one HVP, several circles may relate to the same individual birds. For each area, therefore, the potential as HVP is shown (Rijkswaterstaat, n.y.). The bird numbers of the various sub-areas should therefore not be added together. The low tide counts show data of 2016-2017 per season. Counting took place during one day each season. On that day the location of the birds was checked and recorded three times during low tide (two, four, and six hours after high tide). The maximum of the three counts was used in the map. Therefore, the low tide counting data cannot be interpreted as representing the distribution between the areas at a given time. The HVP numbers should not be related to the low tide counting data since different years and months are used. However, the figure gives a clear indication of the proximity of human activities to foraging areas and HVPs and the possible number of birds that could be disturbed by these activities per season. It is clear that the greatest number of birds would be disturbed in winter.

4.2 Disturbance effects

To establish guidelines for nature conservation, it is important to learn which disturbance effects on vulnerable birds are to be expected from recreation. Schlacher, Nielsen and Weston (2013) studied how human recreation could alter behaviour of non-breeding birds and found, that one-third of the birds' time-budget was expended on activities directly related to disturbance.

Various ways in which birds can be affected by recreation activities are described in literature (Botsch, Tablado, & Jenni, 2017; Krijgsveld et al., 2008; Steven et al., 2011; Tablado & Jenni, 2017). Physiological responses include changes in temperature, changes in hormone levels, increased metabolic rates and increased heart rate. Behavioural responses include increased vigilance, avoidance responses, escape responses, changes in foraging behaviour, and changes in territory establishment. If disturbances are frequent or continuous, physiological effects accumulate causing increased energy expenditure (more frequent flight responses) (Bateman & Fleming, 2017; Krijgsveld et al., 2008; Tablado & Jenni, 2017), reducing individual fitness (Bötsch et al., 2018). As a consequence food requirements may increase, or may not be met because the bird does not have enough time left to forage, or has to move to an area where less food is available (Jonkvorst & Van den Boogaard, 2020). An effect at an individual level should not simply be extended to the population level (AA). However, physiological effects negatively affecting breeding performance, probability of survival, and the possibility to continue migrating and bridging distances, will have an impact at population level (J). According to EE, it is an ecological principle that any disturbance causes a decrease in fitness, starting at the individual level. If sufficiently severe, this could cause a population decline. How this is judged, depends, among other things, on the size of the population (BB, EE). In case of an unfavourable conservation status, each individual bird counts. The flight of an individual bird can therefore affect the conservation objective significantly at

population level if there is no alternative resting or foraging area within the Oosterschelde Natura 2000 area (Jonkvorst & Van den Boogaard, 2020). According to Delphi participant KK, birds leave their habitat when disturbances reach a certain critical level (by frequency/intensity). At the time of flight, the physiological effect has already occurred earlier. In the long run, the bird leaving its habitat can certainly lead to failure to achieve or maintain the conservation objectives (DD, KK).

The extent to which sources lead to disturbance depends inter alia on the predictability of the source of disturbance. Ducks will mostly be disturbed by fast and unpredictable water recreation. However, birds on HVPs, like oystercatchers, could be disturbed by walkers. Delphi participants indicate that the oystercatchers sitting near the Oesterdam in summer may be different birds from the ones seen in winter, which suggests that individual birds are only exposed to a certain recreational activity in a certain season. Intermittent exposure to anthropogenic stimuli, with long intervals between exposures, may not lead to habituation (Blumstein, Fernandez-Juricic, Zollner, & Garity, 2005). Habituation is therefore virtually impossible for migrating birds (EE, II). If birds are present all year round, and human activities become predictable, this can lead to adaptive behaviour (DD). Besides the frequency, intensity and duration of recreational activities, adaptation to human disturbances is also affected by the motivation of a bird to stay in a certain area (Jonkvorst & Van den Boogaard, 2020; Krijgsveld et al., 2008). The biggest threat seems to be fast, unpredictable and prolonged recreational activities that take place during winter (HH).

So, disturbance could lead to both behavioural and physiological effects on birds. The extent depends on the predictability of the source, whether a bird is able to adapt to it, and the season. Not every individual effect will be harmful to the population, but given the unfavourable conservation status of the shelduck, goldeneye and oystercatcher, any disturbance could negatively affect birds' populations.

4.2.1 Disturbance by kitesurfers

Kitesurfing at the Oesterdam takes place from wind force 4 onwards, according to the RUD observations and my own observations. A lower wind force does not seem to be sufficient (P. Engelen, personal communications, June 12, 2020). Preferred wind direction is southwest to northwest. The kitesurfing spot is located at the boundary between land and water, where many birds roost. As a consequence, large numbers of birds are likely to be disturbed (Jonkvorst & Van den Boogaard, 2020). It is necessary to ensure a sufficient number of HVPs a short distance from the foraging areas, and to avoid disturbance to these HVPs (De Ronde et al., 2013).

It became clear that kitesurfing is one of the most disturbing activities in the Oesterdam area, due to its unpredictable movements, and because kitesurfing is the most common form of recreation in winter. Kites high up in the sky have effects on a large area and disturb both foraging birds and swimming ducks. Kitesurfers spend a long time there per visit. Despite the fact that the kitesurfing site

was set up because it was outside a disturbance-sensitive area at the time (Verbeek & Krijgsveld, 2013, p. 55), Delphi participants believe that kitesurfing will negatively influence the conservation objectives. Kitesurfers could also cause negative effects on other important bird areas by surfing outside the designated site boundaries.

The question arose whether kitesurfers use the Oesterdam area at the same time as birds forage on the intertidal flats. Observational data of kitesurfing by RUD Zeeland and data from my own observations were used to determine at which moments related to tide kitesurfers are active. The results are shown in Figure 7. In general, most kitesurfers are active around halfway falling tide and around halfway rising tide (+/- 1 hour). Within the kitesurfing community, the rule is not to kitesurf between two hours before high tide and two hours after high tide (P. Engelen, personal communications, June 12, 2020). However, some kitesurfers are in the area close to high tide, ignoring the advice.

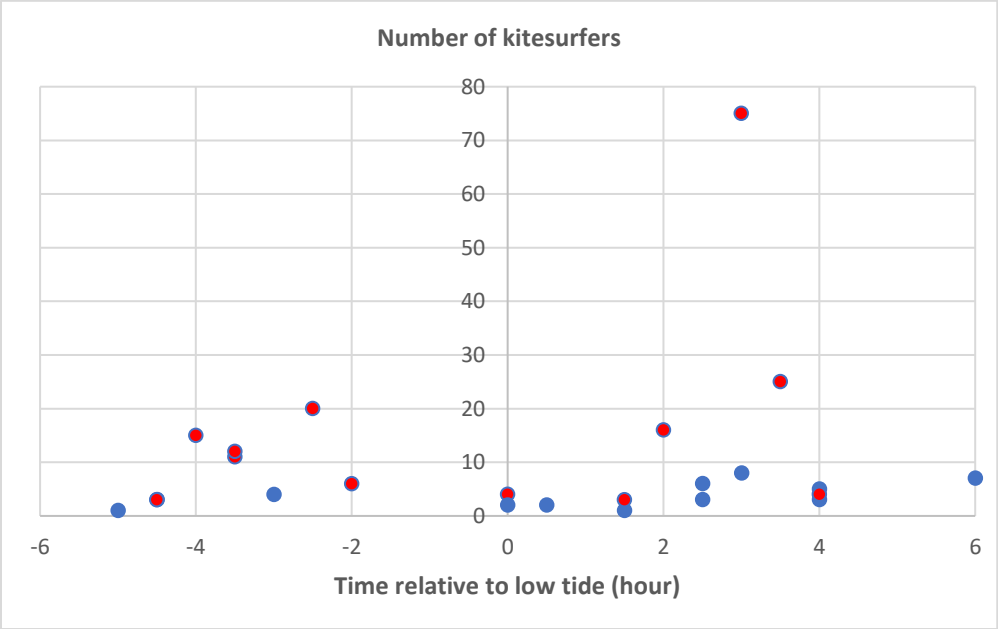


Figure 7: *Number of kitesurfers in the Oesterdam area related to the time relative to low tide. Point 0 on the x-axis is low tide. Negative numbers indicate the time in hours from high tide till low tide. Positive numbers indicate the time in hours during rising tide. Blue dots are the total number of kitesurfers in the water at that moment. Red dots are the number of kitesurfers in the water at that moment, but which will increase soon: this number would increase since an unknown number of kitesurfers is preparing their equipment. Data are based on observations RUD and additional observations.*

The 'Eindadvies Autonome Neerwaartse Trend Oosterschelde' reports that the dispersion of birds is generally related to the distribution of prey, numbers of prey and chance of catching their prey (De Ronde et al., 2013). At falling tides, waders follow the waterline to the usually richer feeding areas lower down in the intertidal zone. At rising tide, they return to the higher parts of the mudflats. Foraging behaviour differs between large and small species, and depends on the season. Oystercatchers forage 6 hours per low tide period in summer. In spring and winter this increases to

7-8 hours per low tide period. Figure 8 shows an example of the number of foraging oystercatchers in relation to the tides and the emersion time in winter in the Oosterschelde (De Ronde et al., 2013). How the birds are distributed over the dry intertidal area depends on the emersion times of the area.

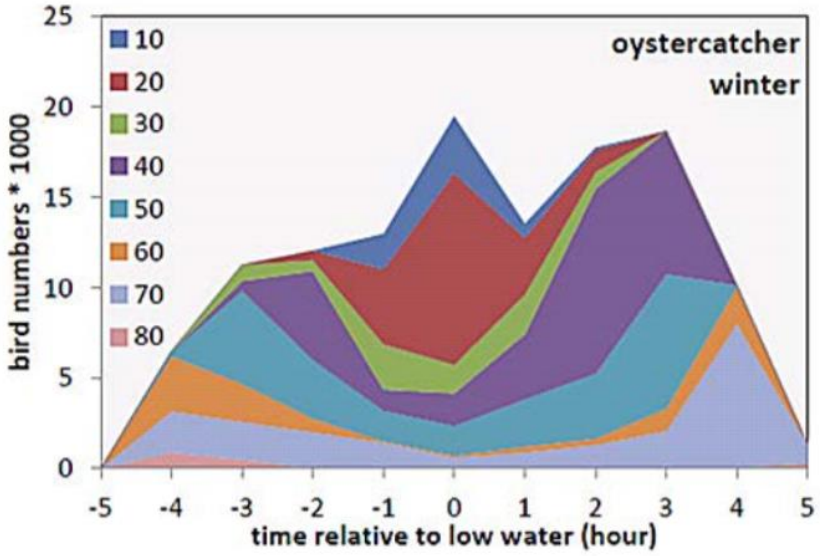


Figure 8: *Number of foraging Oystercatchers in the Oosterschelde during a low tide period and the distribution of the birds over the different emersion time classes (indicated by colour codes) (De Ronde et al., 2013).*

This graph shows that the birds are most numerous in the period between halfway through falling tide and halfway through rising tide. Except for full low tide, these are also the peak moments of kitesurfers at the Oesterdam (Figure 7). This could suggest that if an oystercatcher needs 6-8 hours of foraging time and if kitesurfing takes place on the same day, the bird is very likely to be disturbed during foraging. When it is full low tide, birds have to forage in the zone 0-20% emersion time where food availability is significantly lower. Shellfish, such as cockle and mussel, do occur in high biomass in this area (De Ronde et al., 2013). Although this is suitable food for the oystercatcher, it is not for the shelduck because it is too deep in the soil (Waddenvereniging, 2020). This suggests that the shelduck is not able to forage around full low tide, and the chance of disturbance from kite surfers is even higher. Because the distribution of the birds depends on the availability of food and the season, the distribution in the Oesterdam area will not be entirely the same as in Figure 8. Delphi participant GG emphasizes that more research is required to investigate the real disturbance from kitesurfers on birds and the effect of food availability on birds.

In summary, the disturbance by kitesurfers is expected to be considerable, because the activity is unpredictable and because kitesurfing happens at the time when the birds are most dependent on foraging.

4.3 Uncertainties

In this study, uncertainties emerged concerning the interaction between recreational activities and vulnerable birds. The three kinds of uncertainties are discussed below and summarized in Table 3.

Incomplete knowledge

Some uncertainties are based on lack of knowledge. There is too little knowledge about each specific bird, area and disturbance source. Understanding all these aspects would greatly contribute to determine the disturbance distance, which is often used as a guideline in policy measures. Furthermore, there is a lack of knowledge about the energy balance of disturbed and undisturbed situations for shelduck, goldeneye and oystercatcher. Determination of the long-term consequences of human activities on the population dynamics of these species is therefore complex (DD, II). For shelduck and goldeneye there are too few data on survival, reproduction, and dispersion (BB). The consequences on population dynamics for oystercatchers can be determined with an existing population model. Based on the currently available data, there is insufficient certainty that there are alternative areas with sufficient carrying capacity for all water birds (among which shelduck and goldeneye) and oystercatchers disturbed by kitesurfing (Jonkvorst & Van den Boogaard, 2020, p. 75). Sufficient carrying capacity in alternative areas is affected by 1) food availability and food requirements (AA); 2) whether these alternative places may already be occupied by other species, leading to competition, and 3) the disturbance in that area. There is little data on these aspects. Since there is too little monitoring data on recreation, including data from the period before the area was intensively used, it is difficult to determine the exact effects of recreation and changes in its intensity on birds. Additionally, according to the Delphi participants, there is not enough data available, concerning low tide counts, and concerning compliance to the rules by recreants, affecting disturbance.

Unpredictability

The relationship between effects does not seem to be as simple as shown in Figure 3 in Chapter 2. Changes in bird behaviour do not always flag up disturbances sufficiently or in time. Physiological phenomena already occur with very little disturbance and before any change in behaviour can be observed (Bejder, Samuels, Whitehead, Finn, & Allen, 2009). This was also indicated by the interviewees. It is difficult to determine when disturbance effects start, because: 1) assessing disturbance by recording the moment the birds stop foraging is inconclusive, since this could be part of normal behaviour; and 2) physiological processes are invisible and these precede visible flight responses. However, Ackerman et al. (2004) found that in geese, physiological changes are most prominent during flight initiation, suggesting that physiological responses not related to this moment are expected to be small.

It is uncertain to what extent birds can adapt to certain forms of recreation. The terms 'habituation', 'sensitisation' and 'tolerance' have become increasingly used to describe how animals respond to ongoing disturbances (Bejder et al., 2009). An increase in more instantaneous tolerance levels after frequent disturbances eventually results in habituation over a lifetime. On the other hand, when tolerance levels decrease, this could be a sensitization process. Birds are able to adapt to recreants who are moving in a straight line (like biking), or who are present at fixed moments (D). Kitesurfers move so unpredictably and fast that habituation is hardly likely to occur. In addition, the association with birds of prey would make habituation even more difficult (D, F, I, HH, JJ, KK). This applies in particular to the shelduck and the goldeneye. Oystercatchers may show some degree of habituation according to Delphi participants, for example they can get used to bait diggers (AA). They are, however, migratory birds and do not breed or moult in this area, which makes habituation more difficult. Sometimes certain behaviour is mistaken for habituation, but a moderation in response following a disturbance does not always represent habituation (Bejder et al., 2009). For example, a lack of alternative areas may make the birds decide not to flee. This could be interpreted as habituation, whereas in fact the birds' behaviour is related to a lack of escape possibilities.

Judging the effects at population level when disturbing individual birds is unpredictable. They depend on: 1) how often birds fly away; 2) whether always the same birds fly away; 3) what the physiological/ energetic consequences of flying away are; 4) the life stage of the disturbed birds; 5) what the number of fleeing birds is compared to the total number of birds; 6) what the conservation status of the species is. The effect at population level will not always be measurable. According to HH, for wild bird conservation, birds may not be disturbed[5], which is not as simple as it seems to be:

"It is impossible to know the critical level of each source of disturbance or combinations of disturbance sources per population causing negative effects." (*HH*)[6]

In addition to human access, there are many other unpredictable factors that play a role in the failure to achieve the conservation objectives. The feasibility of conservation objectives is also subjected to autonomous development of the site, the conservation of the whole population, regional conditions, developments elsewhere in the world, and climate change. Conversely, it is possible that the targets will be met despite human access to the area, for example, because the behaviour of birds may change. The effects of the different causes are often difficult to distinguish from each other. In addition, determining a disturbance effect of one activity has little value if the cumulation of effects of other disturbing factors are not considered, according to most Delphi participants. It also matters whether

[5] **Article 4 Bird Directive**: Member States shall take appropriate steps to avoid pollution or deterioration of habitats or any disturbances affecting the birds, in so far as these would be significant having regard to the objectives of this Article. Outside these protection areas, Member States shall also strive to avoid pollution or deterioration of habitats.

[6] "Het is onmogelijk per populatie de kritische grens van elke verstoringsbron en van combinaties van verstoringsbronnen te kennen waarbij negatieve effecten op populatieniveau gaan optreden."

several sources of disturbance occur simultaneously or one by one. If they occur one by one, birds are continuously disturbed and therefore they are likely to avoid such places.

Ambiguity

In addition to the fact that the sources of disturbance at an HVP (high tide roost; *hoogwatervluchtplaats* in Dutch) are different from those in the foraging area, the severity of the effect may also differ (DD, EE). According to J and KK, resting birds at HVPs might be more disturbed than foraging birds since they consider resting as the most important function, maintaining a positive energy balance. When birds are scared away from an HVP, there are often fewer escape possibilities or even no alternatives. During low tide, foraging birds are more dispersed and could forage a little further away or escape more easily. Furthermore, since birds are flocked together in larger groups at an HVP, especially the oystercatcher, the impact of a disturbance would be greater. On the other hand, a different perspective emerged in the Delphi study: disturbance during low tide would be more harmful to birds because they unable to forage. This will increase energy expenditure, which may be higher than when taking flight from an HVP (CC, GG).

The report of the Dutch Kitesurfing Association (NKV) suggests that there is a natural separation between kitesurfers and birds, because kitesurfers seek conditions with strong onshore winds and birds prefer windless conditions (Van der Hulst, 2018, p. 12). According to interviewees D and F, birds will certainly prefer windless conditions. However, this does not mean that they will leave their foraging area or HVP to go to windless areas. Moving means being unable to forage or rest for a certain length of time. Birds are probably not always able to look for windless areas, as this could disturb their positive energy balance. Birds have to forage, even in windy conditions, according to most of the Delphi participants[7] (Figure 9).

Figure 9: *Pie chart showing the variation in answers after the second round of Delphi on statement: "There is a natural separation between kitesurfers and birds, as kitesurfers seek conditions with strong onshore winds and birds prefer wind-free conditions."*

Nevertheless, it remains uncertain what causes the low number of birds seen during the observations when many kitesurfers were present in the Oesterdam area. The wind condition might be a disturbing factor in this case.

[7] **Delphi stelling 4:** 'Er is een natuurlijke scheiding tussen kitesurfers en vogels, omdat kitesurfers omstandigheden zoeken met sterke aanlandige wind en vogels windluwe omstandigheden prefereren.'

Table 3: *Explored uncertainties in the interaction between recreational activities and vulnerable birds.*

Type of Uncertainty	Description
Incomplete knowledge	• Lack of knowledge for each specific bird, area, and disturbance source. • Lack of bird counting data. • Lack of knowledge of energy balance in disturbed and undisturbed situations. • Lack of knowledge of survival, reproduction and dispersion. • Lack of knowledge of availability of suitable alternative areas. • Lack of knowledge and monitoring data about recreation to determine the actual effects of recreation and changes in its intensity on birds.
Unpredictability	• Changes in bird behaviour do not always indicate disturbances early enough or in sufficient measure. • It is uncertain to what extent birds are able to adapt to certain forms of recreation. • Judging the degree of effects at population level when individual birds are disturbed, is uncertain. • Besides human activities, many other factors can lead to disturbance; effects accumulate.
Ambuigity	• It is uncertain whether disturbance during resting is more or less harmful than during foraging. • It is uncertain whether wind conditions create a natural separation between kitesurfers and birds. • Different visions exist on how zoning can be achieved.

In summary, there is generally insufficient knowledge to determine the disturbance effects on vulnerable birds for each specific situation, and the suitability of alternative areas. The decision on conservation measures is complicated by uncertainties about the ability of birds to adapt to certain sources of disturbance and about whether effects on an individual bird will also affect the population. Furthermore, there are different opinions about how harmful the disturbance of a bird on an HVP is, compared to the disturbance at the foraging area, and how zoning could be achieved. Since kitesurfers prefer windy conditions and birds prefer windless conditions, there could theoretically be a natural separation in the use of the area by both parties. In practice, however, this is too uncertain.

4.4 Sand dynamics

In the entire Oosterschelde, intertidal areas with 40-80% emersion time will disappear due to the sand deficit problem. Most benthos is available in the areas with emersion times between 20-60% (De Ronde et al., 2013). Due to food shortages, birds have to escape to alternative foraging areas or they will die (F). In areas with a sand deficit problem, the impact of disturbance on foraging birds is bigger (D). According to De Ronde et al. (2013), the oystercatcher and shelduck are among the species most threatened by food depletion due to sand deficit. This was confirmed to be a threatening factor in the long-term by Delphi participants. The Oosterschelde is the only nature reserve in the Netherlands for which the conservation objectives for waders have been set 10% lower because of the sand deficit problem (D). The effects of the sand deficit can never be counteracted in such a way that conservation objectives will be completely achieved. Therefore, the sand deficit has to be slowed down to a realistic level (H).

Sand nourishments aim at creating an adequate feeding area for birds, also in wintertime. However, it may take up to five years for benthos to recover after sand nourishments. The Oesterdam sand nourishment consists of a main sand nourishment and a dyke foot nourishment (Figure 10), aiming at protection of habitat to preserve its ecological functions for 50 years (M. P. Boersema et al., 2018). The nourishment at the Oesterdam resulted in a significant change in elevation and therefore in emersion time. The nourishment generally showed a fast colonization of benthic species (M. P. Boersema et al., 2018; Walles et al., 2018). Especially cockles and clamshells were developing. This should be profitable for waders like oystercatcher (F). There is less development of ecological richness at the tip of the main sand nourishment and the northern part of the dyke foot nourishment. The lack of other wader species in the Oesterdam study area could be due to disturbance by humans (D).

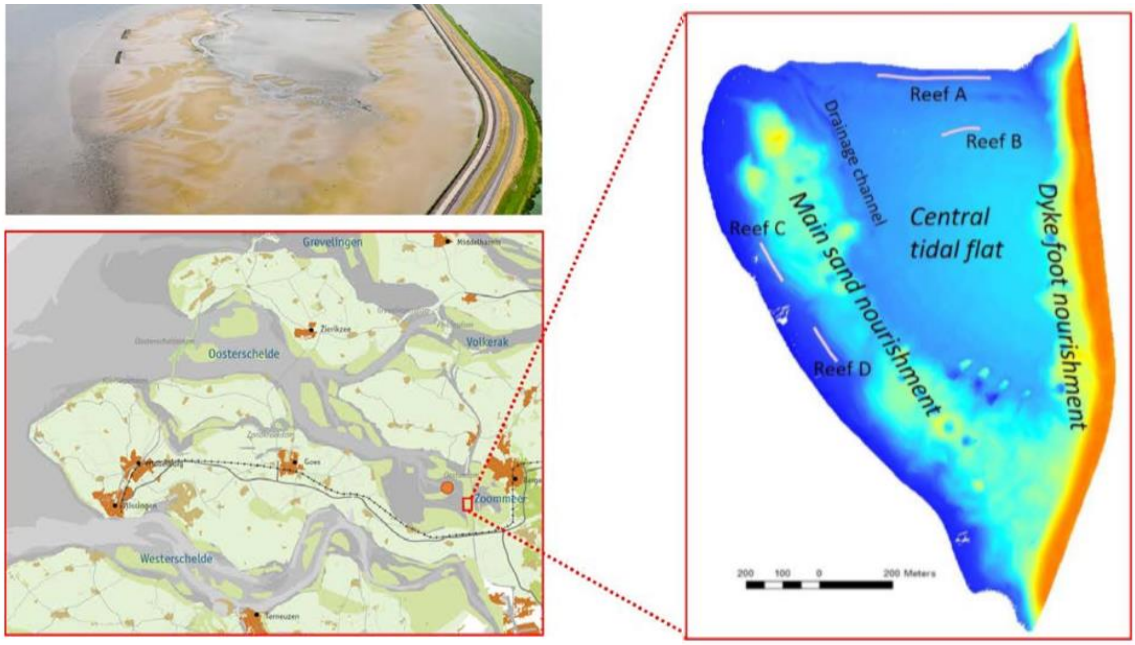


Figure 10: *Sand nourishment at the Oesterdam (M. P. Boersema et al., 2018).*

Sand nourishments have effects on nature, but, as it turned out, also on recreation, especially when the area is easily accessible, like the Oesterdam area. Activities like bait digging and kitesurfing are allowed but are still considered a threat to the area's function as foraging area for waders. This makes sand nourishment in this area less useful (KK). According to Boersema et al., these activities 'will certainly affect bird presence' (M. P. Boersema et al., 2018, p. 64), but the exact impact on foraging birds of disturbance due to the various recreational activities is unknown. Interviewees (F, J) also think that sand nourishment and recreation in the same area are counterproductive:

"To increase the carrying capacity of the area, sand nourishments should be done on intertidal flats that are not accessible to recreants." (F)[8]

[8] "Als je zandhonger wilt aanpakken om de draagkracht van het gebied dusdanig te verhogen om een eventuele negatieve impact van recreatie teniet te kunnen doen, dan zou je dat op de platen moeten doen waar geen mensen bij kunnen komen."

Sand nourishments have a negative effect on birds in the short term, but birds will benefit in the long term. However, when recreation is unmanageable, this positive effect is likely to be undone.

4.5 Nature management

A better understanding of the effects of recreational disturbance on birds is desirable for decision-making. More insights are needed for an update of the Management plan Oosterschelde. Only three bird species were examined in this study. This is not a sufficient base for policy making, but it does provide an insight into the different responses of different bird species to disturbance and sand dynamics, and so highlights the complexity of the issue. In order to minimize the negative effects of recreation on vulnerable birds, several possible measures could be taken. The discussed measures are based on the scenarios in Table AII-1.

4.5.1 Bottlenecks in judging disturbance effects for conservation measures

In judging disturbance effects on vulnerable birds, bottlenecks arise, making nature management more complex. Possible measures and the dilemmas they pose are discussed below and summarized in Table 4.

Sand nourishment

Sand nourishments can restore the foraging function for birds at important sites with decreasing emersion times. It is the only measure that can tackle the problem of sand deficit. Since the sand nourishment area needs time to recover, there will consequently be a temporary disappearance of the foraging area in the short term. Many birds will leave this area, so that recreation in the area would probably be less disturbing to birds. However, it is to be expected that birds will not return after recovery of benthos if recreation prevails here (J). This disturbance effect would not be observable, as no bird will be seen to fly away (J). Sand nourishments will not achieve conservation objectives for the goldeneye, since this bird does not forage on intertidal flats. Rather, the goldeneye seems to get more foraging area due to the sand deficit problem (AA). To protect birds by means of sand nourishments, sufficient HVPs have to be undisturbed as well to guarantee the resting function (AA, KK). Furthermore, sand nourishments only seem to make sense if many other measures are taken first (AA), such as regulating and enforcing recreation at the foraging sites.

Kitesurf prohibition

A kitesurf prohibition could be imposed, as kitesurfing has a major disturbing effect on birds, and because of the safety risk related to the kitesurfing activity. To achieve conservation objectives, decrees (TBB) have been adopted for the 'Kom van de Oosterschelde', stipulating that access is restricted. However, kitesurfing is excluded from this rule and is allowed in the TBB area within the indicated coordinates. To make a prohibition possible, a change in the Management plan and the TBB

Oosterschelde is required. Closing the kitesurf spot at the Oesterdam would encourage infringement according to C, necessitating adequate enforcement. When adequate enforcement is not feasible, prohibiting kitesurfing would not work. A different kitesurf location could be considered, when closing the Oesterdam spot. In order not to relocate the negative effects of kitesurfing, this alternative kitesurf area would have to be the same size, even if it is already overcrowded:

"The increased disturbance could be acceptable if the additional kitesurfers stay within the existing boundaries of the kitesurf zone and are present at the same time." (K)[9]

If there is already disturbance in the area, not every increase in recreation need lead to more increase in disturbance. It concerns the relative increase in recreational users (K, EE, JJ). In practice, however, an alternative kitesurfing spot is often not feasible for the kitesurfers: the limited number of assigned kitesurfing spots is chosen in such a way that it is possible to surf in the Oosterschelde at any wind direction, which could be different from the wind direction at the Oesterdam. In addition, these spots could be too small, or not suitable for beginners (P. Engelen, personal communications, June 12, 2020). Furthermore, if a ban on kitesurfing is the only measure, it does not prevent disturbance by other recreational users. Because the Oesterdam area is not the most favourable area for birds (AA), and because it is very accessible for recreation, it could be a well-considered decision to keep this area open to recreants, while preventing recreation in other bird-centred areas.

Restrict kitesurfing to high tide

To ensure that birds could use the area for foraging, kitesurfing could be restricted to high tide. Now kitesurfing is allowed during high and low tide at the Oesterdam in the assigned kitesurf spot. Restricting kitesurfing to high tide is not realistic given the lack of enforcement and the unsafe situation at high tide. Safety measures, such as fences or safety nets, to prevent people from preparing their kitesurf equipment in the road banking, are assumed not to be feasible (F). In addition, kitesurfing during high tide still disturbs birds on the HVPs.

The Province of Zeeland and Rijkswaterstaat are currently working on making the situation safer for recreants and traffic. A hedge would be placed over the entire kitesurfing zone in the road banking to prevent people from preparing their kitesurf equipment there. In addition, on the road itself, the zone will be more demarcated to make the boundaries more notable (P. Engelen, personal communications, May 20, 2020).

[9] "Verstoring zou dus niet veel meer worden, vooropgesteld dat het in een gebied van dezelfde omvang plaatsvindt. Dat is wel echt cruciaal. En daar komt nog bij… Je hebt in ruimte dezelfde plek, maar ook in tijd. Als er vooral in de zomer gekite wordt, en je moet een uitwijking gaan hebben, waardoor er vervolgens ook in de herfst veel meer gesurft gaat worden, dan moet je het netto-effect wel echt gaan optellen."

Kitesurfing in designated area

While kitesurfing is allowed in the designated area throughout the tide, other recreants (except those with a permit) are not allowed to enter the intertidal areas at low tide, according to the current rules. The observations showed that recreants do not abide by these rules and still trespass in the intertidal zone. Interviewees agreed that it is impractical to allow kitesurfers and to refuse other recreants. This is confirmed by Delphi participants for several reasons: 1) kitesurfing is the activity that is the most disturbing; 2) HVPs continue to be disturbed at high tide, especially by other recreational users, as kitesurfers avoid the area during high tide; and 3) there is no confidence in the enforcement of this regulation.

Allow all recreational activities at both high and low tide

Since the degree of disturbance due to recreation is not obvious, and the trend of the oystercatcher in the Oesterdam area in recent years is relatively favourable (GG), allowing all recreation during both low and high tide could be considered. According to some interviewees, allowing all recreation might be feasible with effective zoning. This measure requires that mitigation of negative effects must take place early on, since the 'hand-on-the-tap' principle[10] is often applied too late (J). Only two Delphi participants think that making the Oesterdam area completely accessible for recreation, is a good measure: it seems impossible to preserve all suitable bird areas in the Oosterschelde. Others state that suitable bird areas should never be given up:

"It is not a question of whether there are sufficient alternative habitats. As a rule, suitable habitat should not be lost. The smaller the suitable habitats, the more vulnerable the system becomes if these areas suddenly lose their carrying capacity." (II) [11]

The habitat lost due to recreation should be compensated one-to-one, both qualitatively and quantitatively, although this will be difficult to achieve in practice. There is little confidence in the required nature compensation and mitigation measures (E), like increasing the carrying capacity of other more important foraging areas in the Oosterschelde.

Zoning

Zoning of activities might help reduce the disturbance impact on the area. Interviewees have different perspectives on zoning of recreation. Since birds are most vulnerable in winter, the foraging areas could be closed for recreation in this period. Time zoning with prohibitions for recreation in winter might protect the shelduck and goldeneye, which are only present in the Oesterdam area in winter. It

[10] Indien uit monitoring van de te beschermen soort(en) in het betreffende gebied blijkt dat instandhoudingsdoelen niet in gevaar komen, kunnen de recreatieactiviteiten en toeristisch-recreatieve voorzieningen gewoon in stand blijven en doorgang vinden. Indien blijkt dat sprake is van een verslechtering van de instandhoudingsdoelstellingen zal worden bepaald onder welke voorwaarden welke (aanvullende) maatregelen noodzakelijk zijn (hand-aan-de-kraan principe) (Henkens et al., 2012).

[11] "Het gaat er niet om of er voldoende uitwijkmogelijkheden zijn (ook wettelijk gezien is dit geen houdbaar argument). Op deze manier wordt altijd de salamitactiek gebruikt. Geschikt habitat mag in de regel niet verloren gaan. Hoe kleiner de nog wel geschikte leefgebieden, hoe kwetsbaarder het systeem wordt als deze gebieden toch ineens hun draagkracht verliezen."

makes less sense for the oystercatcher that could be present in the area all year round. Delphi participants are not convinced that time zoning will allow the birds to get used to kitesurfing movements, even though it will be a recurring phenomenon. Time zoning is considered difficult[12] (Figure 11).

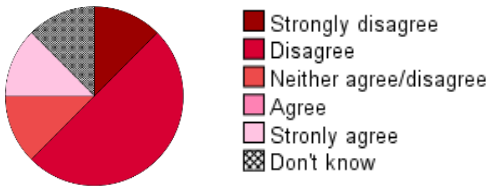


Figure 11: *Pie chart showing the variation in answers on Delphi statement: "Allowing recreation in the Oesterdam area in the summer and prohibiting/restricting in the other months is a good trade-off to protect shelducks, goldeneyes and oystercatchers."*

There is more hope in zoning the space. There are probably other areas that already have a limited emersion time, which makes them less suitable as foraging areas. These could be opened for recreation. Furthermore, recreants could have access in the northern part of the nourishment area since ecological richness is less developed over there (M. P. Boersema et al., 2018). Moving the kitesurf spot to the north were benthos are less abundant, would be an improvement for nature (F). However, the deeper 'choppy' water there is far less attractive for kitesurfing (P. Engelen, personal communications, June 12, 2020). Possibly, arranging small food or drinking facilities could help with zoning and restricting recreation to the assigned areas (G). It is stated by JJ that a zoning plan only works if it is indicated for all bird species. In addition, communication of the rules related to zoning and enforcement of them will be difficult.

Improvement regulations, information provision and communication

Parts of Natura 2000 areas could be extra protected with TBBs if conservation objectives may not be achieved by the management plan only. In Figure 12 the TBB area in the 'Kom van de Oosterschelde' is shown in orange. The kitesurf spot is assigned to this area, right next to the sand nourishment. It seems unclear whether preparing kitesurf equipment is formally allowed in the TBB area. The current information panel at the Oesterdam is open to multiple interpretations, see Chapter 5.

The interviewees emphasized that information, communication, and awareness of possible impact of activities should be improved. At the moment, a new information board is being made, clearly indicating what is and is not allowed, together with a map of the kitesurfing zone (P. Engelen, personal communications, May 20, 2020). All information should be enforceable.

[12] **Delphi stelling 32:** 'Recreatie toestaan in het Oesterdamgebied in de zomer en verbieden/beperken in de overige maanden is een goed compromis ter bescherming van bergeenden, brilduikers en scholeksters.'

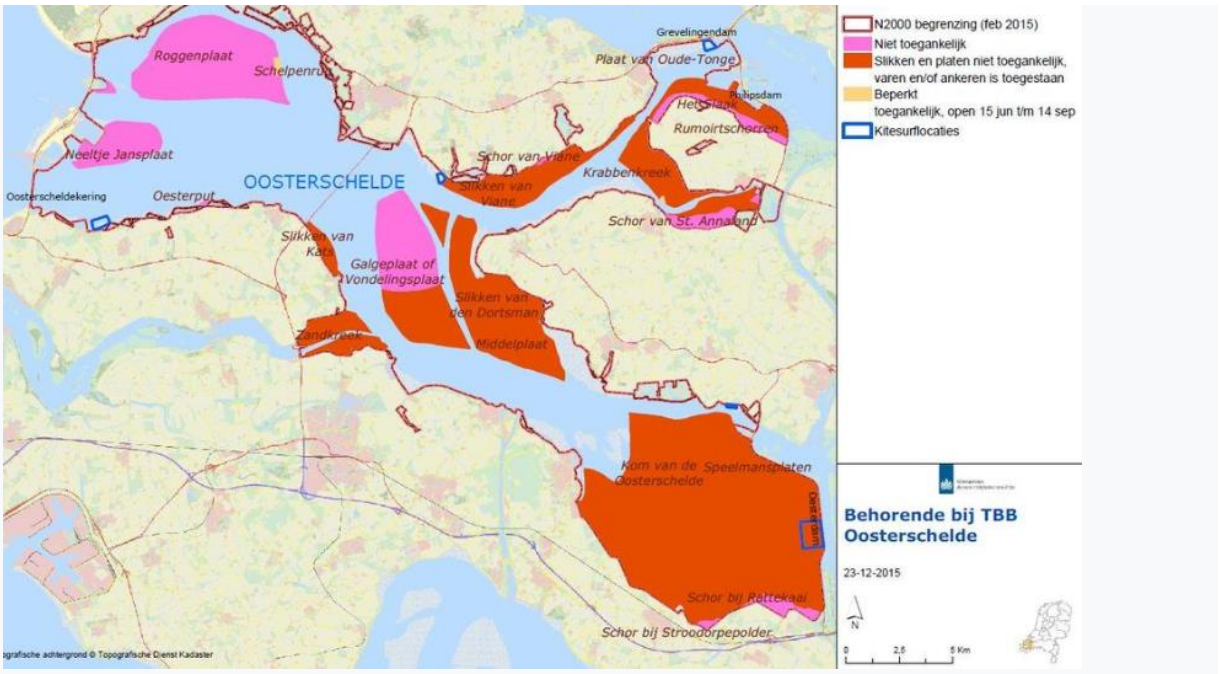


Figure 12: *TBB area in Natura 2000 area Oosterschelde.*

General rules are also communicated within the kitesurfing community. Possible exceptions to the rule, communicated by means of information panels, may therefore be missed. In any case, the information panel should be placed strategically, so that all recreants read the information. Furthermore, according to HH, policymakers and recreational users must be made aware *when* recreation can take place and *where* ('sense of time and place'). It is not about banning all recreation, but about promoting peace by allowing bird-friendly recreation and smart zoning (HH). Not every interviewee agrees on the feasibility of communication and creating awareness (H). It will be the choice of politicians whether recreation, and thus human disturbance, is permitted in a certain area:

"In the end, it is a question of social and administrative will. If you don't do anything, then you shouldn't be surprised if you don't achieve your conservation goals." (K)[13]

Enforcement

People agreed that not enough restrictions have been imposed on Natura 2000 sites, making conservation objectives unattainable. However, some also pointed out that much would be possible within a site, provided that the rules are respected. Lack of enforcement is perhaps the main cause of disturbance. There is little confidence in effective enforcement in the future among interviewees and Delphi participants.

[13] "Uiteindelijk is het een kwestie van maatschappelijke en bestuurlijke wil. Als je niks doet, moet je vervolgens ook niet raar gaan zitten kijken als je je instandhoudingsdoelen niet haalt."; "En in relatie tot het feit dat die vogel flink onder zijn instandhoudingsdoelstelling zit, is dat precies waar het pijnpunt zit: als wij met zijn allen willen dat we het instandhoudingsdoel gaan halen, dan zal er ook iets moeten gebeuren niet alleen maar meer recreatie op plekken gaan toestaan. Want dan gaan we het gewoon niet redden. Zo simpel is het."

Table 4: *Conservation measures and its associated bottlenecks.*

Conservation measure	Bottleneck
Sand nourishment	• Works only if recreation is regulated as well • Temporary disappearance of foraging area • Will not achieve conservation objectives for the goldeneye
Kitesurf prohibition	• Would encourage infringement • Adequate enforcement is needed • An alternative kitesurfing spot is often not feasible • Does not prevent disturbance by other recreational users
Restrict kitesurfing to high tide	• Unsafe situation • Lack of enforcement • Still disturbance of birds at HVPs
Kitesurfing in designated area	• Impractical to allow kitesurfers and refuse other recreants • Kitesurfing is more disturbing than other recreation • HVPs continue to be disturbed at high tide by other recreants • Lack of enforcement
Allowing all recreation at high and low tide	• Risky to allow everything without considering the consequences • Little confidence in the required nature compensation and mitigation measures
Zoning	• Zoning requires clear communication of the rules and enforcement • Areas unsuited for birds are not automatically suitable for recreational users • Works only if it is indicated for all bird species
Information, communication and regulation	• Communication and creating awareness not always feasible • Regulations are not clear
Enforcement	• Lack of enforcement

Although various measures could be put in place, most do not seem effective for all bird species and recreational forms. Furthermore, it seems impossible to communicate and enforce them.

5 Current legislation and public information

During the writing of this thesis, regulations for recreation at the Oesterdam have been under constant review. Initially, the interpretation of current regulations was that kitesurfing was only allowed at high tide, which was also assumed in the scenario's used for this study. Currently, however, the interpretation of the rules is that kitesurfing is allowed during both high and low tide, as long as it stays within the boundaries of the designated site. Ambiguity still seem to exist at Rijkswaterstaat. However, if kitesurfers would comply with a rule of kitesurfing at high tide, dangerous situations would arise in view of the unsafe kitesurf location. The kitesurfing community strongly advises against kitesurfing at high tide.

In June 2019, a consultation took place between Rijkswaterstaat and the Dutch Kitesurfing Association (NKV) with the aim of gaining insight into the needs of kitesurfers. It was stated that under the current rules kitesurfing is only allowed at high tide. The NKV considers this an undesirable situation. Information about the kitesurfing location must be improved, and the rules must not create an unsafe situation. The current information panel indicates that the whole TBB area is inaccessible during low tide, and that kitesurfing is allowed at high tide [14] (Figure 13). This creates the misconception that it is not allowed to kitesurf at low tide and that there is no safety problem. Although not regulated, it is advised that kitesurfing should not happen between two hours before- and two hours after high tide.

Figure 13: *Information panel at the Oesterdam, with difficult to interpret rules.*

In July 2019, the decision to allow kitesurfing only at high tide became more and more controversial. It was generally assumed that kitesurfing, just like other activities, may only take place during periods

[14] Tekst op het informatiepaneel: 'Bij hoogwater mag je hier kitesurfen'.

when the intertidal areas are not dry, falling under Article 4 of the TBB [15] (*Toegangsbeperkingsbesluit Oosterschelde: (kenmerk 17121814).* 2016). This rule would make it impossible for kitesurfers to reach the water at low tide. Nevertheless, the report in which kitesurfing sites have been examined, shows that significant effects on species with conservation objectives are excluded because there should be possibilities to move to nearby intertidal flats (Verbeek & Krijgsveld, 2013, p. 56). The interview with the lawyer of the Ministry of Agriculture, Nature and Food Quality (in Dutch: *Ministerie van Landbouw, Natuur en Voedselveiligheid*, LNV) in the same month indicated that kitesurfing is permitted at all times without restriction, provided it takes place within the designated area, regardless of high or low tide since it is regulated in Article 1 of the TBB[16]. In contrast, other activities regulated in Article 4 of the TBB are only permitted when the tide is in.

In September 2019, there was a discussion about the preparatory activities inextricably linked to kitesurfing, such as rigging, starting, landing, and unrigging, but these were not literally described in the TBB decision. At low tide, it would make sense to do this on the dry intertidal flats of the kitesurfing zone. However, the LNV lawyer has a different interpretation and now states that kitesurfing is *only the activity in the water*. The required preparatory activities would therefore not have been assessed ecologically and not exempted in Article 1 of the TBB*. LNV concludes that kitesurfing is allowed within the kitesurfing site when intertidal flats are dry, but the flats may not be accessed. This applies to every activity because the conservation of relevant bird species is not prospering. An extension of the TBB is therefore not currently an option for LNV.*

The statement by LNV is debatable in two respects:

1. It is unclear on which article this statement is based, because Article 1 does not deal with permission or prohibition to enter dry intertidal areas, although this is the Article which seems to regulate kitesurfing. In Article 4, activities are prohibited when intertidal areas are dry.
2. Entering the water without entering the dry intertidal area seems unsafe, which was never the intention when designating a kitesurfing zone. The test therefore also included starting and

[15] **Artikel 4:** Voor (delen van) de binnen het Natura-2000 gebied 'Oosterschelde' gelegen gebieden '…' en 'Kom van de Oosterschelde', is de toegang gedurende het gehele jaar verboden, behoudens de navolgende uitzonderingen: a. activiteiten die in deze gebieden plaatsvinden in de periode dat deze niet drooggevallen zijn en er water staat, zoals zwemmen, varen en/of ankeren, zijn toegestaan; b. het zich bevinden op het drooggevallen intergetijdengebied van het hoge deel van de plaat tegenover de haven van St. Annaland (Krabbenkreek) is toegestaan in de periode van 15 juni tot en met 14 september daaropvolgend met die restrictie dat het bij zich hebben van een of meer honden niet is toegestaan; c. het betreden van de strekdammen gelegen in de in dit artikel genoemde gebieden is toegestaan voor zover deze strekdammen droogvallen; d. het hobbymatig, handmatig spitten van zeeaas is toegestaan in de daartoe aangewezen gebieden, indien en voor zover men hiertoe beschikt over een vergunning als bedoeld in artikel 19d van de Nb-wet 1998, dan wel deze activiteit is toegestaan krachtens een beheerplan in de zin van de Nb-wet 1998.

[16] **Artikel 1**: Voor het gehele Natura 2000-gebied "Oosterschelde", zowel buitendijks als binnendijks, is de toegang gedurende het gehele jaar verboden voor: a) burgerluchtvaartverkeer (exclusief drones en zweefvliegtuigen) vliegend op 1.000 voet AGL (circa 300 meter) of lager, behoudens operationele noodzaak; b) het beoefenen van het kitesurfen, met uitzondering van de speciaal hiertoe aangewezen kitesurfzones, zoals aangegeven op de bij dit besluit behorende kaart en nader aangeduid met de in bijlage 1 bij dit besluit vermelde coördinaten.

landing on the intertidal flats. If the misinterpretation led to enforcement according to that interpretation, this would lead to unsafety and to risks of legal proceedings.

In October 2019, the legal situation was assessed by a Rijkswaterstaat lawyer (R.J. Sielcken, personal communications, October 29, 2019). It was concluded that, under Article 1 of the TBB, the kitesurfing activity includes starting and landing from the land (edge of a dry plate, which has been assessed ecologically without significant negative effects (Verbeek & Krijgsveld, 2013)). For each human activity at a specific location, access to the site is always implied. After all, without the accessibility of a location, permission for the activity at that location would be meaningless.

At the time of writing (September 2020), it is still not clear whether preparatory activities are allowed on the dry intertidal flats. The argument for them being allowed is that preparation, starting, landing, and packing of kite is an integral part of the kitesurfing activity. The argument against it is the fact that it is forbidden for other recreational users to be in the area when it is partially dry. It is illogical and inexplicable to sunbathers if they are not allowed to enter the intertidal flats, while kitesurfers are.

Impact on research

The interviewees were asked to comment on the probability of the scenarios and on current practice. Scenario A (kitesurf prohibition) does not seem likely because there is little confidence in enforcement of this measure, and in offering a suitable alternative kitesurf location. Scenario B (enforcing current regulations) assumed that kitesurfing was only permitted at high tide. Current practice shows that kitesurfing is mainly taking place at low tide; indeed, this is advised by the kitesurf community. Several interviewees (C, E, F, G) indicated that current practice is the most realistic. Interviewee A indicated that this is not an option without rules and is contrary to the TBB. However, in contrast, kitesurfing during low tide is allowed according to Article 1 of the TBB. Scenario B, on the other hand, was generally not seen as very promising: ‘very unlikely’, ‘only through the courts’, ‘small chance’, ‘hopeless’. The main bottlenecks for Scenario B are enforcement and the technical safety measures. In scenario C, kitesurfing would be allowed at low tide. The views on the probability of this scenario were very diverse. Once again, a frequently mentioned bottleneck was enforcement: no recreational users, except kitesurfers, are allowed on the dry intertidal flats, which is difficult to enforce. That is why the probability of scenario D, in which all recreants can enter the dry intertidal zone, was considered more likely. Nature must be compensated elsewhere in the Oosterschelde to achieve conservation objectives, while the TBB in the 'Kom van de Oosterschelde' would be abolished in this case. Although there was little confidence in scenario C, this scenario appears to be the one that complies with current regulations. For the interviewees, this scenario seems unfair because kitesurfers are always allowed to enter the area, while other recreational users are not.

The different views of stakeholders were presented clearly and allowed for a qualitative assessment.

6 Conclusion

The aim of this thesis was to get insight in how the interaction between vulnerable birds, recreation and sand dynamics complicates Natura 2000 conservation measures in the Oesterdam area.

Based on my research, I have found that sand deficit and recreation reinforce each other's negative effect on birds in varying degrees. The oystercatcher can get used to recreation, the goldeneye is less susceptible to sand deficit, and the shelduck is vulnerable for both recreation and sand deficit.

However, despite the emerging recreation, numbers of shelduck and oystercatcher are relatively positive at the Oesterdam compared to the entire Oosterschelde. For these birds, this may either be an indication of a deterioration in other parts of the Oosterschelde, lacking suitable alternative bird areas, or an increased quality of the Oesterdam area by the sand nourishment. Both emphasize nature management and nature conservation in the entire Oosterschelde area. Natura 2000 conservation measures are complicated because of the following aspects:

1. Although sand nourishments increase the foraging area of birds, they also cause a temporary disappearance of the foraging area, and attract recreation. It is unclear how the interaction between sand nourishments and recreation affects the vulnerability of birds. It is unknown, how bird numbers would have developed in the Oesterdam area without the sand nourishment, and so without the increase in recreants.
2. It is uncertain to what extent different forms of recreation actually disturb the birds, at individual or at population level, making it difficult to determine whether or not recreation is permitted in the Oesterdam area and in what way. Kitesurfers will mainly disturb foraging birds, while other types of recreation can disturb both foraging and resting birds. The impact of all types of recreation will be different for foraging and resting birds. Determining the disturbance effects on vulnerable birds for each specific situation is difficult since there is generally a lack of recreation data and there is insufficient bird species specific knowledge.
3. It is uncertain whether there are sufficient alternative areas, with an adequate emersion time and food availability, for birds within the Oosterschelde to allow recreation in the Oesterdam area. While it is desirable to designate alternative habitats or creating bird-friendly zones, these are not always optimal for every bird species. On the contrary, areas unsuited for birds are not automatically suitable for recreational users.
4. Regulations for kitesurfers and other recreational users are contradictory. This can not be justified; hence, rules are poorly complied with and are difficult to enforce. It is difficult to explain why kitesurfers are allowed in the dry intertidal area of the kitesurf zone, so causing disturbance, while other recreational users are not. However, a clear prohibition on entering the intertidal area at low tide, would certainly limit disturbance to foraging birds on non-kitesurfing days.

7 Discussion

In this chapter I will discuss the relative context of disturbance and vulnerability, zoning as a conservation measure in the Oesterdam area and the Delphi technique as a research method.

7.1 Disturbance and vulnerability

Disturbance and disturbance distance appear to be closely related. The disturbance distance is generally accepted as an indicator of vulnerability: the greater the disturbance distance, the more vulnerable the bird. Factors such as body size, flock size, habituation, environmental conditions, type of disturbance, and individual condition are said to be correlated to disturbance distance (Gill, Norris, & Sutherland, 2001; Jonkvorst & Van den Boogaard, 2020; Krijgsveld et al., 2008; Randler, 2005; Weston, McLeod, Blumstein, & Guay, 2016). However, these factors are not related to vulnerability and to the population consequences of disturbance (Gill et al., 2001). Therefore, the disturbance distance does not seem to be a reliable criterion for conservation measures. Additionally, the potential number of oystercatchers and shelducks in the Oesterdam area within the disturbance distance for kitesurfing (Figure 6) indicate that the disturbance distance is not an optimal standard for conservation measures.

It is advisable to look at additional factors, which are related to vulnerability and bird conservation. Vulnerability seems to be strongly related to emersion times and food availability, especially in the Oosterschelde, suffering from sand deficit. Food availability is a critical factor for survival of the species since food shortage will influence the fitness of the individual, its survival, and reproductive success after migrating to their breeding grounds (Goss-Custard, Hoppe, Hood, & Stillman, 2020). The impact of food shortage can thus have a major impact on the population size and conservation of the species. According to a study of Goss-Custard, Triplet, Sueur and West (2006) the balance between the energy demands of the birds and the opportunity to fulfil them is the most important factor determining whether the critical threshold value for disturbance is high or low. They found that both food abundance and severity of the winter weather had a considerable influence on the level of the disturbance threshold in oystercatchers, despite large numbers of recreants. In another study by Goss-Custard et al. (2020) the amount of birds and people overlapping in time and space, is said to be of critical importance when assessing the impact of disturbance on waders. The cost of disturbance is determined first, by extra energy requirements and lost foraging time through being disturbed into flight, and second, by visiting rates of potential disturbers.

Although the current study was exploratory in nature and I did not actually relate counts of recreants and counts of birds, the results suggest that the amount of disturbing recreation is not the most important aspect of bird vulnerability. First, since numbers of shelduck and oystercatcher show a

relatively positive trend despite emerging recreation. This was particularly noticeable from the moment that the sand nourishment was carried out, suggesting an increase in food availability. There was indeed a quick recovery of nutrient richness and the biomass of benthic animals at the Oesterdam (M. P. Boersema et al., 2018). This could indicate that the positive effect of food availability on bird numbers on a long term, outweighs the negative effect of increased recreation after the sand nourishment, and the temporary disappearance of the foraging area on the short term. That foraging success and trend of the species seem to be related, is confirmed by the less favorable trend of the goldeneye, since the increase of the foraging area is not beneficial for this bird. And second, participants in this study indicate that an increase in recreational activities does not necessarily lead to further disturbance of the birds. This is confirmed by literature: an increase from no disturbance to low-level disturbance is likely to have a proportionally stronger ecological impact than a change from low- to medium level, or from medium- to high-level (Botsch et al., 2017; Monz, Cole, Leung, & Marion, 2010; Steven et al., 2011). Therefore, although recreation in itself seems disturbing, the amount of recreation seems less important. However, the consequences of disturbance at high tide roosts could be different from disturbance during foraging: during rest, birds have no feeding motivation to remain, and they may be more sensitive to disturbance due to an increase in recreation.

Food availability in alternative feeding areas seems to be an important factor for fleeing when birds are disturbed. A lack of alternative areas could motivate the bird to stay in the area in presence of disturbance despite the low feeding quality of the site (Collop et al., 2016), making the disturbance distance smaller. In winter both food availability and disturbance play a crucial role, since in this period, birds cannot afford extra energy expenditure by flights. Birds will have considerably lower disturbance thresholds when feeding conditions are poor (Goss-Custard et al., 2006), and any recreational disturbance can result in higher energy requirements and lost foraging time, increasing vulnerability. Whether there are sufficient alternative areas for disturbed birds in the Oesterdam area is considered the biggest uncertainty regarding a possible extension of the kitesurfing spot by Bureau Waardenburg (Jonkvorst & Van den Boogaard, 2020). The disturbance distance has been leading in their report, although, the real disturbance effect of kitesurfing remains unknown because of lack of knowledge concerning the availability of alternative feeding areas (Jonkvorst & Van den Boogaard, 2020).

Thus, the absence of sufficient food will largely determine the impact of disturbance by an increase in recreation. Assessing both food availability and disturbance thresholds is important for determining the vulnerability of bird species and for deciding on conservation measures.

7.2 Zoning

One way of reducing the pressure of disturbance in a nature reserve and optimally meeting both recreation and conservation objectives, is zoning (Pouwels & Vos, 2001; Stigner, Beyer, Klein, Fuller, & Carvalho, 2016). A zoning plan for recreation cannot be limited to a subarea, since external factors could also endanger the conservation objectives. That is why zoning in the Oesterdam area must also be related to zoning options at regional or national level.

Zoning plans are complicated by a lack of knowledge and a lack of expertise on issues related to recreation, like the different forms of recreation, actual use levels, and the relationships between recreational activities and the area's ecological carrying capacity (Van Marwijk, 2009). This study also showed that there is incomplete knowledge on recreation at the Oesterdam, both types and intensity, to demonstrate a causal relationship with disturbance of birds. In addition, interviewees and Delphi participants had diverging perspectives regarding the ecological and recreational value of the Oesterdam area. Such different views complicate management decisions concerning which specific sites have to be protected to maximize conservation objectives, and which subareas have to be maintained or created for recreational opportunities (Maslo, Leu, Pover, Weston, & Schlacher, 2018).

Since the vulnerability of birds seems to be largely determined by food availability and less by the amount of recreation, food availability should be leading in a zoning plan. A second aspect that will inevitably have to be added to this, is the sand deficit. Taking these aspects into account, zoning could be achieved in several ways. First, subareas in the Oosterschelde with short emersion times and reduced food availability, expected to become unsuitable as foraging area because of the sand deficit on the long term, could be designated as recreational areas. Second, since birds appear to be less vulnerable in the areas with a high food availability, recreation can be allowed in these areas, however, not in an unmanageable way. Recreation could be allowed in time zones when birds are least vulnerable. In the current study, I demonstrate that most kitesurfers are active between 2-4 hours after high tide (Figure 7). Although depending on the bird species and recreational activity, disturbance in this period could be critical, since birds are foraging on parts with a high food availability (De Ronde et al., 2013) (Figure 8). However, applying a time zoning on this scale seems impossible. To meet the needs of most vulnerable birds, there could be a temporary closure of the Oesterdam area in winter since this is the most vulnerable season for birds. That bird species could react differently to changing protection strategies has to be taking into account (Maslo et al., 2018). Recreation in summer could be allowed since benthos is then sufficiently available. Thirdly, subareas where less food is available and which are habitats of bird species whose conservation objectives are threatened, should be completely closed to recreation. In this case, it must be ensured that adjacent high tide roosts are also protected from disturbance. Finally, because of a lack of knowledge on sand nourishments, future

nourishments should be made completely inaccessible for recreation to allow benthic animals to recover.

A zoning plan based on food availability and bird species could be better manage recreation, because areas with less ecological value could be fully opened up for recreation. Both kite surfing and other recreational activities can be allowed under consistent rules, regardless of the tide or whether the intertidal area is dry or not. This reduces the chance of illegal access and makes enforcement easier. This zoning plan gives rise to a middle ground with regard to Van Marwijk's two views on the relationship between recreation and nature (Van Marwijk, 2009): nature and recreation as partners or as rivals. It shows both a combination and a separation of nature and recreation in Natura 2000 area Oosterschelde, that could prevent and mitigate conflicts between nature and recreation, supporting the achievement of conservation goals.

7.3 Delphi-method

The Delphi-technique was one of the methods used to gain more insight into which aspects of the interaction between vulnerable birds, recreation and sand dynamics affect Natura 2000 measures. No group meetings are needed and it guarantees the anonymity of the participants. Unlike the classical consensus-based Delphi technique, the Delphi used in this study aims to collect different views. Interviews were conducted prior to the Delphi. Information from the interviews was used to make additional statements or refine statements. The main emphasis of this study is the ecological aspect of the interaction between birds, recreation and sand dynamics. This is partly due to the choice to allow only ecological experts to participate in the Delphi study in order to gain insight into whether, and which, different views or knowledge exist among experts that could influence this issue.

Answering the research questions by assessing statements turned out to be more difficult than expected. There are several causes. First, the statements could be interpreted in different ways. Second, responding to a statement like *'A new sand nourishment is a suitable measure if conservation objectives of shelduck, goldeneye and oystercatcher will not be achieved'*, does not guarantee that sufficient information is gathered about sand nourishments as a conservation measure. Participant CC also expressed this criticism, thinking that most of the variation in the answers was caused by the way the statements were formulated. It also turned out to be difficult to apply nuances to the responses to statements: 'I haven't checked it, but I think I have ticked "neutral" quite often. That's because I often see things nuanced. That's why the other possibilities often don't fit so well', (AA)[17]. Thirdly, sometimes the response to a statement was based on a wish instead of a feasibility, like the statement:

[17] 'Ik heb het niet gecontroleerd, maar ik denk dat ik vrij vaak "neutraal" heb aangekruist. Dat komt, omdat ik zaken vaak genuanceerd zie. Daardoor passen de andere mogelijkheden vaak niet zo goed.'

'There are possibilities to compensate (qualitatively and quantitatively) for the habitat in a Natura 2000 site that is lost through recreation.' A participant answers, 'completely agrees' with the explanation: 'This is what we like, but there must be radical action then'. Here it is not clear whether the participant actually thinks there are really possibilities to do so. These difficulties indicate that doing good qualitative research using the Delphi-method, and mapping out the different visions of the participants properly, strongly depends on the explanations given. Some participants gave extensive explanations, but others rarely did this due to lack of time. As a result, valuable information may not have been shared. Experts who have less experience in the area will answer from theory, or from their experience elsewhere. Because of this, answers can be very diverse.

The lack of direct interaction can lead to frustration among the participants (Mukherjee et al., 2015). In this Delphi study, frustrations and doubts about the method arose occasionally during the first round. Because of this I thought about a group meeting as closure, but in the end, I decided not to do this: dilemmas of group meetings, like social pressure, could arise in such a meeting, which could negatively influence expert judgement without being beneficial. I preferred to make different interpretations and views transparent to the participants in a different way: arguments for or against a statement were created from the explanations of the participants in the first round. In the second round, the statements that had not reached a 70% consensus in the first round were submitted to the participants again. Arguments were linked to this through 'because' and 'however', for example *'Since there are only a limited number of suitable kitesurfing days per year, and it is not sure how much disturbance birds can tolerate, prohibition of kitesurfing would be excessive,'* because '*other activities could be just as disturbing'*; and however, '*from the precautionary principle, kitesurfing should be prohibited.'* It was noteworthy that participants often agreed with the arguments of other participants, while they usually stuck to their first response to the statement. This strategy goes beyond getting insight in statements, which could be open to multiple interpretations. The added value is unravelling the statement what gives participants the possibility to go into detail on various aspects of the statement.

In the end, the goal of the Delphi for this study was achieved: a wide variety of views of different experts were collected that could encourage a debate leading to the formulation of conservation measures. Bottlenecks and uncertainties in the interaction between vulnerable birds, recreation, and sand dynamics became more explicit. Quantitatively, it also provides clear insights into the distribution of answers among ecological experts. The use of arguments in the second round is recommended because it gives the opportunity to clarify interpretations and to focus it even more on the case.

8 Recommendations

This research clearly shows the complexity of the interaction between vulnerable birds, recreation and sand dynamics. Based on this study I have two concrete suggestions for conservation measures in the Oesterdam area and a recommendation for further research. Firstly, it is recommended to close off the Oesterdam area completely to all recreation during the winter months. In winter, there are considerably higher numbers of shelducks, goldeneyes and oystercatchers in the Oesterdam area. Also, this is a relatively important habitat for these birds compared to the Oosterschelde as a whole, and, it is unclear whether there are sufficient alternative areas. Protecting birds in winter will reduce the danger of them entering the breeding season in poorer condition as a result of food limitation during the winter. Improved fitness could protect bird species at population level. Second, regulations for both kitesurfers and other recreants should be the same, so that they are clear and equitable. As a result, recreants would be more likely to comply with the rules. Third, the use of the whole Oosterschelde area by both birds and recreational users should be structurally monitored, during both high and low tide. Food availability should also be explored. This supports research into the simultaneous use by recreational users and birds, with the aim of gaining further insight into a possible dose-effect relationship concerning disturbances, and the suitability of the area as feeding area or recreational area. Based on these results, a more detailed zoning plan could be drawn up for the Oesterdam area and the surrounding area, so that conservation objectives for birds can be achieved and recreants can experience nature.

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Appendix I: Dutch newspaper articles and photographs of the Oesterdam area

PZC 01-07-2019

Kitesurfen bij Oesterdam mogelijk verboden: vogels hebben er last van

OESTERDAM - Het kitesurfen bij de Oesterdam tussen Zuid-Beveland en Tholen kan straks zomaar voorbij zijn. Dat komt doordat de watersporters foeragerende vogels zouden verstoren. Rijkswaterstaat en de Nederlandse Kitesport Vereniging zoeken naar een oplossing.

Verbod

,,We zitten met een dilemma", zegt woordvoerster Anneloes Lockefeer van Rijkswaterstaat. ,,Bij laagwater vallen de zandplaten waar vogels foerageren droog. Wie dan gaat kiten, verstoort de vogels. Als dat belang zo groot is, kan het in theorie uiteindelijk leiden tot een verbod op kiten."

Bij hoogwater mag er wel gekitesurft worden, zegt Lockefeer. ,,Maar we vinden het ook niet fijn dat de veiligheid dan in het geding is. Vandaar dat er overleg is tussen verschillende partijen." Om tot een oplossing te komen, zijn Rijkswaterstaat en de NKV in gesprek. Halverwege juni hadden zij een eerste overleg, binnenkort volgt het volgende. ,,Ondertussen wordt kiten bij laagwater gedoogd", zegt Lockefeer.

Kitesurfers die gebruik maken van de populaire locatie zitten sowieso al in een bijzondere situatie. Bij hoogwater mogen ze er hun gang gaan, maar dan vinden de kiters het zelf te gevaarlijk. Bij laagwater mag het niet van Rijkswaterstaat omdat de vogels er dan last van hebben. Nu wordt kiten nog gedoogd, maar mogelijk niet lang meer.

Kiten bij hoogwater is gevaarlijk omdat het water dan tot aan de dam komt, legt Mark Gorter van de Nederlandse Kitesurf Vereniging (NKV) uit. ,,Het is absoluut uit den boze om dan te gaan kiten. De wind perst zich samen bij de dijk. Je kunt zó een windstoot krijgen of er kan iets misgaan met het oplaten. In het ergste geval vliegt de kiter dan over de weg. Dat kan heel slecht aflopen."

VVV-folder

Gorter, locatiebeheerder van de spot aan de Oesterdam, hoopt op begrip voor de sport. ,,Kiten groeit, en moeten we de ruimte geven. We hebben aan de Ooster- en Westerschelde honderden kilometers aan vloedlijn waar vogels kunnen foerageren. Veilige locaties vinden en kitezones maken, dat is voor iedereen een haalbare kaart zolang je niet in het broedgebied of op de schorren zit. Op elke VVV-folder zie je een plaatje van een kitesurfer. Het is een visitekaartje voor Zeeland. Als je dat uitdraagt, moet je het ook opnemen in je beleid."

Mocht kiten aan de Oesterdam verboden worden, dan is het dichtstbijzijnde alternatief het water bij Strijenham op Tholen. De surfspots in de Zimmermangeul (bij Rilland) en bij Krabbendijke (Roelshoek) zijn al een paar jaar verboden gebied. Verderop in de provincie zijn wel meer kitesurfplaatsen: drie in de Oosterschelde en negen in de Westerschelde.

Figure 1: *Birds and kitesurfers at the Oesterdam.*

PZC 16-07-2019

Vogelwerkgroep ageert tegen kitesurfers op Oesterdam

OESTERDAM - De Vogelwerkgroep Bergen op Zoom ziet de kitesurfers bij de Oesterdam tussen Zuid-Beveland en Tholen het liefst vertrekken. De watersporters storen foeragerende vogels.

Rijkswaterstaat en de Nederlandse Kitesport Vereniging zijn bekend met het probleem; ze zoeken samen naar een oplossing. Dat was voor de Vogelwerkgroep reden om een brief aan Rijkswaterstaat te sturen. ,,Een deel van de voorlanden van de Oesterdam is aangewezen als kitesurfzone bij hoogwater. De werkelijkheid komt er neer dat kitesurfers juist bij laagwater actief zijn, omdat surfen dan veiliger is. Kortom, hier botsen de belangen van natuur en recreatie'', schrijft voorzitter Jan Hogerwaard van de Vogelwerkgroep Bergen op Zoom.

Als het aan de Vogelwerkgroep ligt, wegen de natuurbelangen zwaarder dan het surfgenot in het besluit van Rijkswaterstaat.

Figure 2: *Photographs of the Oesterdam area:*
a) Disturbed oystercatchers;
b) Parked cars and preparatory kitesurfers on the Oesterdam;
c) Busy kitesurfing day; and
d) Kitesurfers preparing their equipment in the intertidal area.

Appendix II: Scenarios

Table 1: *Scenarios of recreational activities in the Oesterdam area elaborated by Rijkswaterstaat and the Province of Zeeland.*

Huidige praktijk	**Scenario A: Kitesurfen verbieden**	**Scenario B: Huidige beleid handhaven**	**Scenario C: Kitesurfen met laag water toestaan**	**Scenario D: Uitbreiding C met toestaan van overige vormen van recreatie**
	Mogelijke maatregelen onderzoeken:			
- TBB/N2000 regelgeving wordt niet gehandhaafd; er zijn geen verbodsborden; - kitesurfen vindt plaats bij hoog water, wat kan leiden tot verkeersonvelige situaties (landen/oplaten kites moet plaatsvinden op parallelweg of middenberm i.p.v. periodiek drooggevallen slik); - zandsuppletie wordt door recreanten gebruikt als strand; - onderhoudsstrook naast parallelweg wordt gebruik als perkaarplaats waardoor ook bereikbaarheid van hulpdiensten in het geding komt	*Onderzoek effecten door mogelijke toename op andere bestaande kitesurf locaties *alternatieve kitesurflocaties beschikbaar maken in plaats van Oesterdam? (Yerseke/Krabbendijke/Zimmerman) *aandachtspunten inrichting (verbodsborden ed) *communicatie *handhaving alle activiteiten	*Onderzoek effecten door mogelijke toename op andere bestaande kitesurf locaties *alternatieve kitesurflocaties beschikbaar maken in plaats van Oesterdam? (Yerseke/Krabbendijke/Zimmerman) *maategelen nemen tbv veiligheid naar wegverkeer (geleiderail/vangnet/?) *Voorstel inrichting op hoofdlijnen: - Markeren kitesurfzone - verbodsborden - parkeersituatie *communicatie *handhaving alle activiteiten	Wat zijn de effecten van kitesurfen bij laag water op vogels? 1) Met huidig vak 2) Met geoptimaliseerd vak voor kitesurfers (in relatie tot laag water/windrichting en aantallen kitesurfers) *Nieuw/aangepast kitesurfvak nodig? Waarom? Waar? *mitigatie / compensatie natuur? *maategelen nemen tbv veiligheid kitesurfers naar wegverkeer (geleiderail/vangnet/strand creeëren/?) *Voorstel inrichting op hoofdlijnen: - Markeren kitesurfzone; - verbodsborden; - parkeersituatie *communicatie *handhaving alle activiteiten	Als C. Specifiek aandacht voor effecten en mogelijke mitigatie van negatieve effecten van combinatie van kitesurfers en overige recreatie.
	Eerst indicatieve weging			
	++ natuur - - kiten - - recreatie + veiligheid	+ natuur - kiten - - recreatie -- veiligheid	0 / + natuur[18] - of 0 kitesurfen[19] - - recreatie 0 veiligheid	0 / + natuur[20] - of 0 kitesurfen[21] 0 recreatie 0 veiligheid

[18] Afhankelijk van de vraag of er nu buiten het vak wordt gekitesurft
[19] idem
[20] idem
[21] idem

Appendix III: Participants

Table 1: *Interviewees and participants of Delphi study (in Dutch).*

Naam	**Organisatie**	**Functie**
GEINTERVIEWDEN		
Jorrit Bijl	Kenniscentrum voor Kusttoerisme	Onderzoeker
Bas van den Boogaard	Bureau Waardenburg	Projectleider vogelecologie
Gerrit Dommerholt	Vogelbescherming Nederland	Projectleider
Aylin Erkman	Rijkswaterstaat	Ecoloog
Teus van Hattum	Minsterie van Landbouw, Natuur en Voedselveiligheid (LNV)	Jurist LNV/regiegroep Deltawateren
Wilco Jacobusse	Nationaal Park Oosterschelde	Coördinator communicatie & educatie
Marion Pross	Provincie Zeeland	Beleidsmedewerker
Ben Sandee	Gemeente Reimerswaal	Beleidsmedewerker
Jan Willem Slager	Rijkswaterstaat	Omgevingsmanager
Brenda Walles	Wageningen Marine Research	Mariene Ecoloog
Eric van Zanten	Rijkswaterstaat	Morfoloog
DEELNEMERS DELPHI		
Silvana Ciarelli	Rijkswaterstaat	Adviseur waterkwaliteit en ecologie
Floor Arts	Deltamilieu	Projectleider Deltamilieu Projecten
Frans van Zijderveld	Natuurmonumenten	
Gerrit Dommerholt	Vogelbescherming Nederland	Programmamanager Kust- en Intergetijdengebieden
Dick de Jong		(oud) RWS Adviseur ecologie/morfologie
Maarten Platteeuw	Rijkswaterstaat	Senior adviseur ecologie en natuur(wetgeving)
Mark Hoekstein	Deltamilieu	Ecoloog / vogelonderzoeker
Peter Meininger	Rijkswaterstaat	Adviseur ecologie, voormalig organisator vogeltellingen
Rienk Geene	Habitat Advies	Ecoloog
Tijmen den Ottelander	Natuurmonumenten	Boswachter natuurbeheer
Wannes Castelijns	Het Zeeuws Landschap	Ecoloog
Sonja Hartlief	Vogelbescherming Nederland	Beleidsmedewerker wetlands
Nico Korporaal	Vogelbescherming Nederland	Beleidsmedewerker wetlands
Wouter Stempher	Natuurmonumenten	

Appendix IV: Results

Table 1: *Bird counting in Oesterdam area during observations in September and October 2019.*

	Shelduck ***(number)***	**Goldeneye**	**Oystercatcher**	**Tide**	**Wind force (beaufort)**	**Observed recreational activities**
September	65	-	2124	Rising tide (ca. 29cm NAP - 154cm NAP)	3	4 cyclists
October	51	-	3340	Rising tide (ca. 52cm NAP - 112cm NAP)	4	2 cyclists, 1 supper

Table 2: *Observations of recreational activities in the Oesterdam area (July 2019-July 2020).*

	Weather condition	**Wind direction/force**	**Tide**	**Recreational activities: number of recreants**
14 July 2019	Half to heavily cloudy; 19 degrees	N 4	Rising tide (ca. -39cm - 9cm NAP)	Cycling: 43 Walking: 9 Dogs: 5 Swimming: 5 Fishing: 1 Sea food/bait digging: 7 Sun bathing/resting: 1
17 July 2019	Sunny, little veil cloud cover; 24 degrees	NE 2	Rising tide (ca. 34cm -77cm NAP)	Cycling: 33 Walking: 2 Dogs: 2 Swimming: 7 Fishing: 3 Sea food/bait digging: 10 Sun bathing/resting: 16

	Weather condition	Wind direction/force	Tide	Recreational activities: number of recreants
30 July 2019	Sunny; 26 degrees	S 4	Rising tide (ca. 52cm - 96cm NAP)	Cycling: 5 Walking: 30 Dogs: 3 Swimming: 3 Fishing: 3 Sun bathing/resting: 20 Kitesurfing: 4 Preparing equipment (on dam): 4 Windsurfing: 3
29 Augustus 2019	Half cloudy; 22 degrees	W 4	High tide (ca. 181cm - 190cm NAP)	Cycling: 4 Sun bathing/resting: 3 Windsurfing: 1
12 January 2020	Half to heavily cloudy; 9 degrees	SW 4	Rising tide (ca. -1cm - 37cm NAP)	Walking: 2 Kitesurfing: 25 Windsurfing: 3 Preparing equipment on dam: 6
29 April 2020	Heavily cloudy; 16 degrees	SW 4	Rising tide (ca. -48cm - -24cm NAP)	Walking: 5 Kitesurfing: 3 Windsurfing: 1 Cycling: 3
6 June 2020	Half to heavily cloudy; 16 degrees	SW 5	Rising tide (ca. -55cm NAP)	Walking: 3 Kitesurfing: 75 Windsurfing: 14 Preparing surf equipment on intertidal flats/dam: 28 Dogs: 1

	Weather condition	Wind direction/force	Tide	Recreational activities: number of recreants
28 June 2020	Partly cloudy; 19 degrees	SW 5	Low tide (ca. 78cm NAP)	Walking: 2 Dog: 1 Kitesurfing: 15 Preparing kitesurf equipment on intertidal flats/dam: 20 Windsurfing: 11 Preparing windsurf equipment on intertidal flats/dam: 10 Cycling: 15 Sunbathers: 2

Table 3: *Monitoring of kitesurfing at the Oesterdam, information provided in Dutch (RUD Zeeland, 2019).*

Datum	Tijdstip observatie	Wind	Tijdstip waterstanden	Kitesurfers
31-07-2019	18:00	ZW 4	LW 21:55	6 kitesurfers te water, grote aantallen kitesurfers maakten zich gereed om te water te gaan
01-08-2019	08:15	ZW 4	LW 10:15	Geen kitesurfers te water
	11:15	ZW 4	HW 17:06	4 kitesurfers te water, meerdere kitesurfers maakten zich gereed om te water te gaan
06-08-2019	08:15	ZW 4	HW 08:40	Geen kitesurfers te water
07-08-2019	12:00	W 4	LW 15:08	4 kitesurfers te water
08-08-2019	08:30	WZW 4	HW 10:10	Geen kitesurfers te water
	17:30	WNW 3	HW 22:25	Geen kitesurfers te water
12-08-2019	08:30	ZW 4	HW 14:35	Geen kitesurfers te water
	11:15	ZW 4	HW 14:35	6 kitesurfers te water
13-08-2019	08:30	WZW 4	LW 09:05	Geen kitesurfers te water
14-08-2019	15:00	W 3	HW 16:21	Geen kitesurfers te water
	17:30	W 3	LW 22:21	Geen kitesurfers te water
20-08-2019	08:15	WZW 4	LW 13:15	Geen kitesurfers te water
	16:30	WNW 4	HW 19:35	8 kitesurfers te water
21-08-2019	09:45	WZW 2	LW 13:45	Geen kitesurfers te water
	16:00	NNW 2	HW 20:06	Geen kitesurfers te water
22-08-2019	09:15	ZW 2	LW 14:16	Geen kitesurfers te water
	11:15	ZW 2	LW 14:16	Geen kitesurfers te water

Datum	Tijdstip observatie	Wind	Tijdstip waterstanden	Kitesurfers
28-08-2019	08:15	ZW 3	LW 08:16	Geen kitesurfers te water
	17:50	NW 2	LW 20:50	Geen kitesurfers te water
29-08-2019	08:15	WZW 3	LW 09:16	Geen kitesurfers te water
	11:20	WZW 3	HW 15:51	1 kitesurfer te water
03-09-2019	08:15	WZW 4	LW 13:06	1 kitesurfer te water
	15:15	W 4	HW 19:46	3 kitesurfers te water en 3 kitesurfers maakten zich klaar om te water te gaan
04-09-2019	11:15	ZW 4	LW 13:50	11 kitesurfers te water en diverse kitesurfers maakten zich gereed om te water te gaan
	16:30	WZW 5	HW 20:26	16 kitesurfers te water en diverse kitesurfers maakten zich gereed om te water te gaan
05-09-2019	08:15	NW 4	HW 08:53	Geen kitesurfers te water
10-09-2019	08:30	Z 1	HW 14:11	Geen kitesurfers te water
	16:30	NW 2	LW 20:16	Geen kitesurfers te water
11-09-2019	08:20	WZW 4	LW 08:45	Geen kitesurfers te water
	17:45	ZW 5	HW 15:16	12 kitesurfers te water en diverse kitesurfers maakten zich klaar om te water te gaan
12-09-2019	09:00	WZW 4	LW 09:40	Geen kitesurfers te water
	18:00	W 4	LW 22:03	Geen kitesurfers te water
16-09-2019	09:15	ZW 2	LW 11:35	Geen kitesurfers te water
	17:15	N 3	HW 18:10	Geen kitesurfers te water
17-09-2019	07:00	NNW 3	LW 12:16	Geen kitesurfers te water
	16:45	NNW 4	HW 18:41	5 kitesurfers te water
18-09-2019	08:15	ONO 2	LW 12:45	Geen kitesurfers te water
	17:45	NNW	HW 19:11	Geen kitesurfers te water
26-09-2019	18:00	ZW 4	LW 20:26	20 kitesurfers te water en 9 kitesurfers maakten zich gereed op het slik
27-09-2019	16:00	ZW 5	LW 21:25	3 kitesurfers te water en 4 kitesurfers maakten zich gereed op het slik
30-09-2019	12:15	W 4	HW 18:01	2 kitesurfers te water
	14:45	W 4	HW 18:01	3 kitesurfers te water
02-10-2019	17:15	NW 5	HW 19:20	3 kitesurfers te water
08-10-2019	19:25	WZW 5	HW 01:05	2 kitesurfers te water
11-10-2019	17:00	ZW 5	LW 21:25	3 kitesurfers te water
16-10-2019	18:00	ZZW 5	HW 18:10	7 kitesurfers te water
22-10-2019	17:10	WNW 3	HW 22:41	Geen kitesurfers te water
28-10-2019	13:30	NW 1	HW 15:51	Geen kitesurfers te water
	16:30	ZW 3	LW 21:30	Geen kitesurfers te water
29-10-2019	16:20	ONO 4	HW 16:31	Geen kitesurfers te water
05-11-2019	17:20	ZW 2	HW 22:01	Geen kitesurfers te water
07-11-2019	17:30	ZW 5	LW 17:49	Geen kitesurfers te water
11-11-2019	16:15	WZW 4	LW 20:56	Geen kitesurfers te water
14-11-2019	17:25	ZZO 3	LW 22:35	Geen kitesurfers te water
24-11-2019	16:45	ZZW 4	LW 21:56	Geen kitesurfers te water

Datum	Tijdstip observatie	Wind	Tijdstip waterstanden	Kitesurfers
25-11-2019	16:30	ZZO 3	LW 20:19	Geen kitesurfers te water
10-12-2019	15:30	ZZW 6	LW 20:20	Geen kitesurfers te water
11-12-2019	17:30	ZW 4	LW 20:55	Geen kitesurfers te water

Table 4: *Dutch Interview fragments provided by interviewees.*

Nr	Interview fragment	Interviewee
1	*"Bij de Oesterdam waren we er ons vanaf het allereerste begin bewust van het risico van de recreatie, dat die het over zou nemen, want het was al een plek die was aangewezen om bodemdieren te mogen spitten. We hadden daar een opdracht om een veiligheidsbuffer neer te leggen ter bescherming van die dijk. Dat was niet echt een natuurdoelstelling. En tijdens het ontwerpproces werden we ineens geconfronteerd dat het in een keer een kitesurfplek werd…… We moesten ook nog de ruimtelijke kwaliteit verbeteren van de Oesterdam en omgeving… Toegevoegde waarde van landschapsbeleving en toerisme…. Dus eigenlijk zou je kunnen zeggen dat het bijna tegenstrijdige doelstellingen waren. "*	H
2	*"En nu zitten er gewoon honden-uitlaat-services, er wordt zelfs paardgereden, er zijn kitesurfscholen die daar gewoon hun tenten opslaan!"*	H
3	*"Het is niet een structureel probleem. Er vindt geen 365 dagen per jaar een veiligheidsprobleem plaats. Het heeft te maken met de wind, met de stand van het water, met het aantal kiters, met het verkeer dat daarlangs gaat (veel werkverkeer). In zijn totaliteit maakt dat het een hele onveilige situatie. Maar hoe vaak heb je al die factoren per jaar tegelijkertijd? Dat is denk ik wel beperkt. Maar dat is wat iedereen zegt 'het hoeft maar een keer fout te gaan…'"*	C
4	*"Als er iemand had nagedacht over het feit dat een kite daar niet veilig is op te laten omdat het gebied daar niet groot genoeg is, dan was daar nooit een kitesurflocatie gekomen."*	F
5	*"…. Ik denk dat er meer illegaliteit gaat komen….. Ze gaan niet hun hobby opzeggen omdat iemand het gebied verboden heeft. En dan wordt het waarschijnlijk veel gevaarlijker."*	C
6	*"Het kan zijn dat vogels dus kunnen wennen aan recreatie, vooral als het voorspelbaar is. Dat is een belangrijke eis! Maar soorten die dat niet kunnen, die zullen dan verdwijnen."*	D
7	*"Je moet eigenlijk weten 'wanneer moet ik op welke plek wel zijn, en wanneer moet ik er niet zijn'. Die getijbeweging moet je kennen, en…. Vogels gaan ook met het getij mee, bij overstromend tij zoeken ze hoge plekken op. En als mens moet je eigenlijk net de tegenovergestelde beweging maken."*	J
8	*"Recreatie moet kunnen aantonen dat dat geen verstorend effect heeft. …. Het is heel moeilijk dat cijfermatig aan te tonen. Er zijn veel onzekerheden."*	C

Nr	Interview fragment	Interviewee
9	*"….dat we nog niet heel goed aan kunnen geven wat de omvang van de effecten is, omdat we ook niet heel specifiek kijken wat doet recreatie met de vogels. We kunnen alleen maar kijken, hoe veranderen de aantallen."*	D
10	*"Voor de recreatie in opkomst kwam, daar zijn wat minder monitoringsgegevens van, minder gedetailleerd. Dan loop je achter de feiten aan, als je nu effecten gaat bepalen."*	A
11	*"Is er nou in de Oosterschelde nu echt geen andere ruimte over waar die vogels worden opgenomen? Is die er nou echt niet? Onze hypothese is dat die er niet is, maar is die er nou echt niet? Kunnen de vogels niet gewoon een beetje indikken op een andere plek? Dat is de onzekerheid."*	H
12	*"…je gaat de achteruitgang niet stoppen, maar vertragen tot een zeker niveau waarvan we vinden met zijn allen dit is realistisch. En om dat te doen ga je je richten op de belangrijke gebieden van de Oosterschelde voor het foerageren, en ga je kleine randgebiedjes loslaten, daar is dan echt wel plek voor de mens. Echt zoneren"*	H
13	*"En nogmaals, dan vind ik dat er ook een + komt voor recreatie omdat je er dan onbezorgd kan recreëren. Sterker nog, misschien kunnen er dan ook activiteiten aan gekoppeld worden, dat je het daar op die plek dan ook stimuleert dat mensen echt de natuur beleven, dus niet alleen zwemmen maar ook krabbetjes zoeken of mooie dingen zien waarvan ze ook echt de natuurwaarde zien. Daar krijg je dan ook meer mogelijkheden voor."*	G
14	*"Dus eigenlijk zijn we het stadium van het voorzorgsprincipe al lang voorbij. Het is nu andersom eigenlijk, we hebben een gebied waarvan we weten dat het een heel belangrijke functie heeft en kwetsbaar is, maar we accepteren dat er toch recreatie is."*	G
15	*"Mijn gevoel zegt me gewoon t.a.v. die update van N2000 beheerplan… als je die illusie hebt om heel erg veel dingen tot in detail te gaan zitten uitzoeken en dan hebben we een antwoord op wat voor bewegingsruimte we binnen zo'n gebied hebben… ik denk dat dat een heel lastig verhaal gaat worden. Dat je beter vanuit een voorzorgsprincipe het N2000 plan zou moeten gaan optuigen…"*	K
16	*"Je moet benadrukken dat als je het hier gaat toestaan, dan is het hek van de dam want het TBB besluit is de ruggengraad van N2000. Zonder TBB besluit kun je heel N2000 in de prullenbak gooien."*	A
17	*"Volgens mij is het juist vanuit kitesurfen algemeen gezegd 'met laag water moet je gaan varen…. 'En dat staat haaks op de regels die we bij de Oesterdam hanteren."*	C
18	*"Maar het ging me even om de systematiek van dit besluit. Dat noemt heel uitdrukkelijk 'dit is voor de kitesurfers geregeld' (artikel 1) en 'dit is voor de andere activiteiten geregeld' (artikel 4). En dat is belangrijk om dat onderscheid te maken. Toelichting zegt ook dat artikel 1 de kitesurfers regelt. Ik lees het niet anders dan dat kitesurfen is toegestaan in de daarvoor aangewezen gebieden, en daar geldt niet voor laagwater/hoogwater etc. Het gaat alleen om de gebieden…. En dat zegt de toelichting ook, als je je tot het toegestane gebied beperkt dan is die mogelijke verstoring niet zodanig van invloed op de instandhoudingsdoelstellingen. En bij artikel 4 hebben ze het over andere activiteiten. En er zijn er meer te noemen, maar kitesurfen is apart geregeld in het TBB. Als er uitdrukkelijk onderscheid wordt gemaakt, dan kun je andere artikelnummers vergeten (tenzij het expliciet genoemd wordt). En wil je nog meer doen dan wat TBB beschrijft, dan is er sprake van vergunningplicht en moet je dus dubbel toetsen. Als je iets over kitesurfen wilt zeggen, dan ben je gebonden aan artikel 1 en de toelichting op artikel 1."*	I

Nr	Interview fragment	Interviewee
19	*"En handhaven is sowieso altijd al een dingetje geweest. Mooi op papier, maar het is niet snel gerealiseerd. Je kunt veel beter met mensen in gesprek gaan."*	C
20	*"De regels vanuit het gebied van N2000 kennen zij niet. Dat vind ik misschien wel de grootste meetfout die erin zit. Zij zijn niet op de hoogte van de werkelijke regel. Voor hun hebben zij andere regels. Dat is een heel groot ding wat fout gaat."*	C
21	*"Er wordt ook wel eens wat geprobeerd via social-media door de kitesurfers zelf, maar er wordt ook wel eens informatie verspreid die niet klopt, en ze maken niet altijd de handigste keuzes. En dat is heel lasting."*	E
22	*"Daar staan mensen niet voor open. Het zal zeker wel iets helpen maar uiteindelijk zijn 1 of 2 individuen met een loslopende hond al voldoende om honderden vogels een heel getij te verjagen. En tot dat niveau van bewustwording gaan wij niet geraken. Mensen die denken 'flikker toch op met die vogels'…"*	H
23	*"….wat ik het probleem daarvan vind, is dat als mensen hier zien dat het eigenlijk niet mag maar dat het toch gebeurt, denken ze dan op andere plekken 'maakt schijnbaar niet uit in de Oosterschelde'… ….Daar zit voor mij het grootste punt: als mensen daar dus schijnbaar de regels niet serieus hoeven te nemen, hoe kun je dan wel van ze verwachten dat ze dat op andere plekken van de Oosterschelde wel doen? Daar zit dus echt een communicatieprobleem"*	G
24	*"Uiteindelijk is het een kwestie van maatschappelijke en bestuurlijke wil. Als je niks doet, moet je vervolgens ook niet raar gaan zitten kijken als je je instandhoudingsdoelen niet haalt."*	K
25	*"En in relatie tot het feit dat die vogel flink onder zijn instandhoudingsdoelstelling zit, is dat precies waar het pijnpunt zit: als wij met zijn allen willen dat we het instandhoudingsdoel gaan halen, dan zal er ook iets moeten gebeuren niet alleen maar meer recreatie op plekken gaan toestaan. Want dan gaan we het gewoon niet redden. Zo simpel is het."*	K
26	*"Als er een dode valt, dan is het morgen gebeurt. Dan komen er hekken omheen. Het gaat naar de grens toe. Je krijgt mensen daar niet weg, door te zeggen 'het is zonde van de vogels'. Kitesurfers zijn op zoek naar het gewenste antwoord maar dat zullen ze niet krijgen."*	I
27	*"De grootste onzekerheid is denk ik dat ik niet weet of de momenten van de vogels altijd botsen met de momenten van de recreant."*	C
28	*"Verstoring zou dus niet veel meer worden, vooropgesteld dat het in een gebied van dezelfde omvang plaatsvindt. Dat is wel echt cruciaal. En daar komt nog bij… Je hebt in ruimte dezelfde plek, maar ook in tijd. Als er vooral in de zomer gekite wordt, en je moet een uitwijking gaan hebben, waardoor er vervolgens ook in de herfst veel meer gesurft gaat worden, dan moet je het netto effect wel echt gaan optellen."*	K
29	*"Ik denk dat het er onveiliger op wordt. Het creëert een soort schijnveiligheid."*	F
30	*"Want als kitesurfers een lobby hebben, hebben de andere recreanten natuurlijk ook een lobby. Als je de een meer vrijheden geeft, gaat de andere meer steigeren, 'zij mogen wel, en wij mogen niet', hoe kan dat?'"*	D

Nr	Interview fragment	Interviewee
31	*"Als je er miljoenen aan uitgeeft om natuurbehoud te doen, waarom zou je dat dan direct de nek om draaien door er een kitesurflocatie naast te leggen?.... ….die zandsuppletie is heel duur en die is om de natuur een impuls te geven en om die vogels waardevol slik te geven, waar ze kunnen eten. En vervolgens ga je daar kitesurfen toelaten en wordt er niet gehandhaafd???? ….dan heb je überhaupt nooit goed nagedacht over de locatie."*	F
32	*"Je kunt het bijna afschrijven als foerageergebied als je het openstelt voor recreatie. Nu komen er al veel recreanten, terwijl het niet mag, laat staan hoeveel er komen als het wel mag."*	E
33	"*Het is misschien wel de meest realistische. Want, heel flauw, hoeveel geld gaan we spenderen aan het handhaven? En gaan wij dan nog steeds de verstoringen voorkomen? Persoonlijk denk ik niet. Verstoringen zullen altijd plaatsvinden. Kiten is niet helemaal te verbieden, dat is een utopie."*	C
34	*"En hoever wil de politiek gaan om de vogels te beschermen en willen ze maatregelen treffen om dit te doen?"*	D

Table 5: *Uncertainties concerning the interaction between human activities and vulnerable birds emerged from interviews related to the different categories of the interviews.*

Kind of uncertainty	Description	Interviewee
Incomplete knowledge	• Lack of knowledge of effects on specific species, in specific areas and by specific disturbance sources.	D, K
	• Lack of knowledge of effects of changes in intensity of recreational activities on behaviour of specific species	E, I
	• Lack of knowledge of disturbances, e.g. whether these are area specific.	D, F
	• Lack of knowledge of effects of sand nourishments on recovery of benthos (composition and abundance).	D, F, H
	• It is not clear what the actual course of recreational pressure in time and space has been over the past 20 years.	K
	• Lack of knowledge of availability of suitable alternative areas.	D, F, H, K
	• Lack of knowledge of foraging behaviour of wader species, like 'how many birds are foraging', 'how do they forage?', 'how do they disperse?'	D
	• Knowledge gap concerning the tolerance of disturbances by bird species	D, F
	• We do not know whether possible declines in bird counts are due to an ineffectiveness of closing areas, or the inadequacy of enforcement of these areas.	D
	• Whether a certain number of birds in an area at a giving time, reflects the maximum number is uncertain.	K
Unpredictability	• We cannot know which species will react in which specific way on changes in intensity of recreational activities	E, I
	• We cannot know whether bird species will react the same on disturbances in another area.	D, F

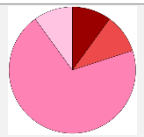
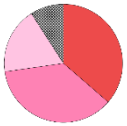
Kind of uncertainty	Description	Interviewee
	• We cannot know how bird species are disturbed if the same number of tourists/recreants will be spread out over a larger area, and how this will influence conservation objectives.	C
	• We cannot know how benthos will recover.	D, F, H
	• It will not always be obvious what the source of the disturbance is.	C, D, J
	• It is not clear what the numbers of birds would have been at the Oesterdam if the recreation had not been there.	K
	• We cannot see when physiological effects start to occur.	D, F, J
	• Judging the degree of effects on population level when disturbing individual birds is uncertain.	J
	• It is unknown if the same bird species will return after sand nourishments.	D, F, H
	• Human behaviour is unpredictable and public support for decisions is uncertain.	A, C, F, G, H, I, J
	• Whether a certain number of birds in an area at a giving time, reflects the maximum number is uncertain.	K
	• It is uncertain whether more detailed research will provide more clarity.	K
Ambiguity	• People can disagree about the source of the disturbance.	C, D, J
	• It is ambiguous whether disturbing foraging birds with low tide and disturbing resting birds with high tide.	J, K
	• Although juridical it can be stated that there are no *significant* negative effects, the severity of disturbing could be differently interpreted by ecological experts.	I
	• Different visions exist on how zoning can be achieved.	A, B, C, D, E, F, G, H, I, J
	• Kitesurfers are restricted to the borders of the kitesurf zone, but whether they may only be in the water or also on the intertidal flats depends on interpretation.	I
	• Since preparing the kite is not explicitly mentioned it could be interpreted as belonging to kitesurfing in article 1 and allowed on the intertidal flats, or as another activity in article 4 being not allowed on the intertidal flats.	I

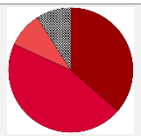
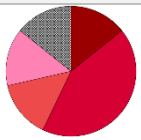
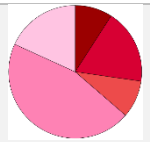
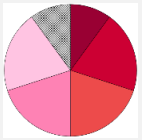
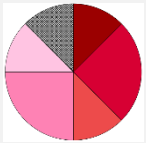
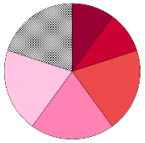
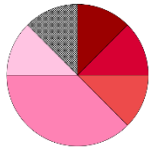
Table 6: *Uncertainties originating from the Delphi study.*

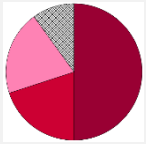
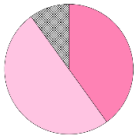
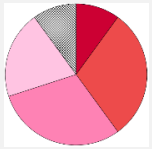
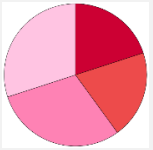
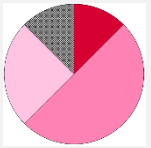
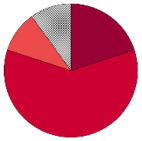
Kind of uncertainty	Description
Incomplete knowledge	• It is unclear whether more kitesurfers at a kitesurfing location also leads to more disturbance for birds. • It is questionable whether the oystercatcher would be present on the Oesterdamplaat in much larger numbers without recreation. • It's unclear what the impact of the sand deficit problem is on the goldeneye. • There is uncertainty about the vulnerability of the goldeneye in the Oesterdam area. • It is uncertain that vulnerable birds will be able to find an alternative habitat with sufficient carrying capacity. • It is not sure whether a few birds leaving the area has impact on the population. • The consequences of the long-term effects of human activities on the population dynamics of shelduck, goldeneye and oystercatcher are unlikely to be determined with existing knowledge. • It is unclear if, and to what extent shelducks are present in the Oesterdam area in summer. • Knowledge about the species is incomplete. • It is unclear what the chances are of increasing the carrying capacity of a foraging area elsewhere by giving up the area near the Oesterdam for recreation.
Unpredictability	• It is unclear whether more kitesurfers at a kitesurfing location also leads to more disturbance for birds. • It is questionable whether the oystercatcher would be present on the Oesterdamplaat in much larger numbers without recreation. • It is not clear whether new sand nourishments can have a positive effect on the achievement of the conservation objectives of shelduck, goldeneye and oystercatcher. • It is uncertain that vulnerable birds will be able to find an alternative habitat with sufficient carrying capacity. • If circumstances are less favourable in an alternative area is uncertain. • It is not sure whether a few birds leaving the area has impact on the population. • It is not clear what the real reason for the unfavourable conservation status of a bird population is. • It’s uncertain if zoning in time (recreation only allowed in summer) can protect the oystercatcher. • It's unclear what the effect of banning kitesurfing near the Oesterdam would be on birds. • Even if access to intertidal flats is prevented, it is not clear whether the conservation objectives will be achieved. • It is unclear what the chances are of increasing the carrying capacity of a foraging area elsewhere by giving up the area near the Oesterdam for recreation.

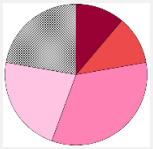
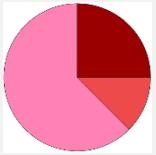
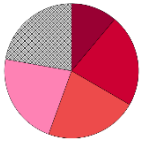
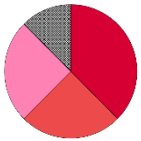
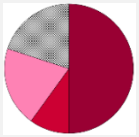
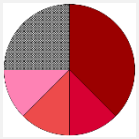
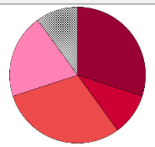
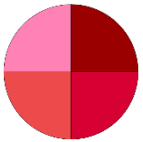
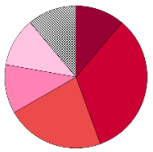
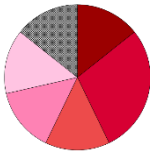
Kind of uncertainty	Description
Ambiguity	• It is unclear whether disturbance of birds in the foraging area or on an HVP has more impact. • It is unclear whether more kitesurfers at a kitesurfing location also leads to more disturbance for birds. • It's unclear what the impact of the sand deficit problem is on the goldeneye. • There is uncertainty about the vulnerability of the goldeneye in the Oesterdam area. • It is not sure whether a few birds leaving the area has impact on the population. • It is unclear whether conservation objectives are not achievable because too few restrictions have been imposed on Natura 2000 sites. • It's unclear what the effect of banning kitesurfing near the Oesterdam would be on birds.

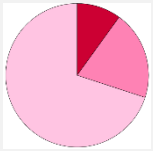
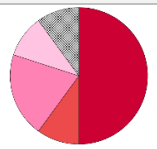
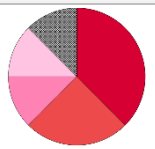
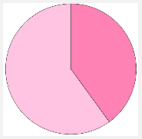
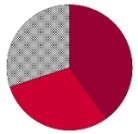
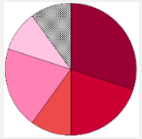
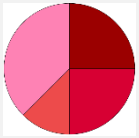
Table 7: *Results from Delphi round 1 and 2 (quantitative). Text in Dutch since the questionnaire was written in Dutch.*

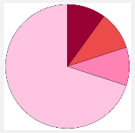
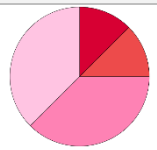
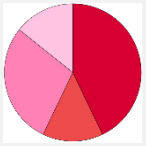
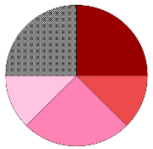
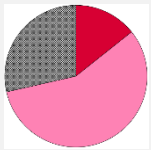
Stelling		**Ronde 1**		**Ronde 2**	
Nr.	*Omschrijving*	Helemaal mee oneens Mee oneens Niet mee eens/ oneens Mee eens Helemaal mee eens Weet niet	*Consensus*	Helemaal mee oneens Mee oneens Niet mee eens/ oneens Mee eens Helemaal mee eens Weet niet	*Consensus*
1	Vogels op hoogwatervluchtplaatsen hebben andere verstoringsbronnen dan vogels bij laagwater (vogels in foerageergebied).		80% (helemaal) mee eens		
2	Recreëren bij hoogwater geeft net zoveel verstoring als recreëren bij laagwater omdat het de vogels op de hoogwatervluchtplaatsen verstoort.		-		-

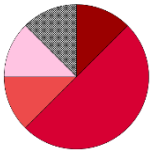
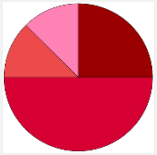
Stelling		Ronde 1		Ronde 2	
Nr.	*Omschrijving*	Helemaal mee oneens Mee oneens Niet mee eens/ oneens Mee eens Helemaal mee eens Weet niet	*Consensus*	Helemaal mee oneens Mee oneens Niet mee eens/ oneens Mee eens Helemaal mee eens Weet niet	*Consensus*
3	De bergeend, brilduiker en scholekster kunnen wennen aan kitesurfbewegingen door adaptatie.		82% (helemaal) mee oneens		
4	Er is een natuurlijke scheiding tussen kitesurfers en vogels, omdat kitesurfers omstandigheden zoeken met sterke aanlandige wind en vogels windluwe omstandigheden prefereren.		-		-
5	Het herstellen van foerageergebied middels zandsuppleties in de Kom van de Oosterschelde is zinloos als je recreatie niet weert uit het gebied.		-		
6	**Stelling eruit gehaald: bleek (ongeveer) dezelfde te zijn als stelling 5**				
7	Omdat je niet weet hoe de bodemdieren zich gaan ontwikkelen na zandsuppleties, weet je niet of je met zandsuppleties *bedreigde* vogelsoorten zal beschermen.		-		-
8	De bergeend, brilduiker en scholekster worden meer verstoord (fysiologische verschijnselen) door menselijke activiteiten als ze in het verstoorde gebied blijven, dan als ze het gebied verlaten en verstoring vermijden.		-		-

Stelling		Ronde 1		Ronde 2	
Nr.	*Omschrijving*	Helemaal mee oneens Mee oneens Niet mee eens/ oneens Mee eens Helemaal mee eens Weet niet	*Consensus*	Helemaal mee oneens Mee oneens Niet mee eens/ oneens Mee eens Helemaal mee eens Weet niet	*Consensus*
9	Kitesurfen binnen de aangewezen zone zal niet voor significant negatieve effecten zorgen omdat er uitwijkmogelijkheden voor de vogels zijn. Het is zeker dat deze vogels een andere locatie kunnen vinden met voldoende draagkracht.		73% (helemaal) mee oneens		
10	Het optreden van fysiologische verschijnselen (zoals verhoogde hartslag of veranderde hormoonspiegels) bij de bergeend, brilduiker en scholekster die ontstaan door verstoring kunnen uiteindelijk leiden tot het niet halen van instandhoudingsdoelstellingen.		82% (helemaal) mee eens		
11	Het wegvliegen van enkele individuele vogels heeft geen effect op populatieniveau.		-		-
12	**De originele stelling werd anders geformuleerd in de tweede ronde, zie stelling 28**				
13	Incidentele verstoringen hebben geen effect op populatieniveau van bergeend, brilduiker en scholekster. *(N.B. In de tweede ronde werd 'geen effect' vervangen door 'slechts een minimaal effect' op basis van kritische toelichting van de deelnemers).*		-		75% (helemaal) mee eens
14	De gevolgen van effecten van menselijke activiteiten op lange termijn op de populatiedynamiek van bergeend, brilduiker en scholekster kunnen met de bestaande kennis bepaald worden.		73% (helemaal) mee oneens		

Stelling		Ronde 1		Ronde 2	
Nr.	*Omschrijving*	Helemaal mee oneens Mee oneens Niet mee eens/ oneens Mee eens Helemaal mee eens Weet niet	*Consensus*	Helemaal mee oneens Mee oneens Niet mee eens/ oneens Mee eens Helemaal mee eens Weet niet	*Consensus*
15	De huidige kennis over de effecten van recreatie op bergeend, brilduiker en scholekster, is voldoende om regels op te stellen voor recreatie in het Oesterdamgebied.		-		-
16	Om de bergeend, brilduiker en scholekster het minst te verstoren, is het zoneren van recreatie in tijd (seizoen) een goede maatregel.		-		-
17	Door kitesurfen te verbieden in het Oesterdamgebied ter bescherming van de vogels, zullen kitesurfers uitwijken naar andere kitesurflocaties waardoor het daar drukker wordt. Kitesurfen verbieden in het Oesterdamgebied is daarom een zinloze maatregel.		-		-
18	Een deel van het Oesterdamgebied volledig afstaan aan recreatie, en de draagkracht van een ander foerageergebied in de Oosterschelde verhogen, is een goede maatregel.		-		-
19	**De originele stelling werd anders geformuleerd in de tweede ronde, zie stelling 29**		-		-
20	Een nieuwe zandsuppletie is een geschikte maatregel als instandhoudings-doelstellingen van bergeend, brilduiker en scholekster niet gehaald worden.		-		-

Stelling		Ronde 1		Ronde 2	
Nr.	*Omschrijving*	Helemaal mee oneens Mee oneens Niet mee eens/ oneens Mee eens Helemaal mee eens Weet niet	*Consensus*	Helemaal mee oneens Mee oneens Niet mee eens/ oneens Mee eens Helemaal mee eens Weet niet	*Consensus*
21	Het habitat in een Natura 2000 gebied dat verloren gaat door recreatie zou één-op-één gecompenseerd moeten worden (kwalitatief en kwantitatief).		82% (helemaal) mee eens		
22	Er zijn mogelijkheden om het habitat in een Natura 2000 gebied dat verloren gaat door recreatie één-op-één te compenseren (kwalitatief en kwantitatief).		-		-
23	Omdat er te weinig beperkingen zijn opgelegd aan het gebruik in Natura 2000 gebieden, zullen veel instandhoudingsdoelstellingen niet haalbaar zijn.		100% (helemaal) mee eens		
24	De kitesurflocatie bij de Oesterdam is aangewezen omdat het buiten een verstoringsgevoelig gebied voor vogels ligt. Kitesurfen zal de instandhoudingsdoelstellingen dus niet negatief beïnvloeden.		73% (helemaal) mee oneens		
25	Aangezien er jaarlijks maar een beperkt aantal geschikte kitesurfdagen zijn, en we niet goed weten hoeveel verstoring vogels kunnen tolereren, gaat het verbieden van kitesurfen te ver.		-		-
26	Kitesurfen toestaan binnen de kitesurflocatie bij zowel hoog- als laagwater, en overige recreatie beperken tot hoogwater, is een juiste maatregel om het instandhoudingsdoel van de bergeend, brilduiker en scholekster te behalen.		91% (helemaal) mee oneens		

Stelling		Ronde 1		Ronde 2	
Nr.	*Omschrijving*	Helemaal mee oneens Mee oneens Niet mee eens/ oneens Mee eens Helemaal mee eens Weet niet	*Consensus*	Helemaal mee oneens Mee oneens Niet mee eens/ oneens Mee eens Helemaal mee eens Weet niet	*Consensus*
27	Het bepalen van een verstorings-effect van één activiteit heeft geen waarde als je niet naar de cumulatie van effecten van andere storende factoren kijkt.		82% (helemaal) mee eens		
28	Iedere menselijke verstoring kan leiden tot afname in populatie.	Gewijzigde stelling uit ronde 1			75% (helemaal) mee eens
29	Het voorkómen van betreding van drooggevallen intergetijdengebieden, hoeft het behalen van instandhoudingsdoelstellingen niet makkelijker te maken.	Gewijzigde stelling uit ronde 1			-
30	In het Oesterdamgebied is de kwetsbaarheid van brilduikers gering.	Nieuwe stelling in ronde 2			-
31	Een zoneringsplan voor recreatie in het Oesterdamgebied ter bescherming van de scholekster is haast onmogelijk.	Nieuwe stelling in ronde 2			-

Stelling		Ronde 1		Ronde 2	
Nr.	*Omschrijving*	Helemaal mee oneens Mee oneens Niet mee eens/ oneens Mee eens Helemaal mee eens Weet niet	*Consensus*	Helemaal mee oneens Mee oneens Niet mee eens/ oneens Mee eens Helemaal mee eens Weet niet	*Consensus*
32	Recreatie toestaan in het Oesterdamgebied in de zomer en verbieden/beperken in de overige maanden is een goed compromis ter bescherming van bergeenden, brilduikers en scholeksters.	Nieuwe stelling in ronde 2			-
33	Om een indicatie te krijgen van verstoring van het gebied door menselijke activiteiten, zou het voldoende zijn om alleen de impact van verstoring op de *kleine* steltlopers te beschouwen (zowel kwantitatief als kwalitatief).	Nieuwe stelling in ronde 2			75% (helemaal) mee oneens